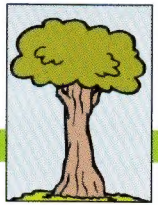
Where does latex come from?



PLANTS AND TREES

1. Large desert cactus
2. The hevea tree
3. A mine in Texas

©1995 Nintendo

Hevea

The hevea tree grows in the Amazon basin of South America. This tree is highly valued because it is the source of latex, from which rubber is made.

2 Latex comes from the hevea tree.

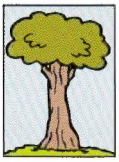


Photo © Desjardins / Explorer

Latex , a rubber gum, flows from gashes in the bark of the hevea tree. The latex is used to make many different products, including paint.

The Indians of the Amazon basin have long known the value of the tree they call "ca-hu-chu," which means "the tree that cries." When you see how the latex is taken from the tree, you'll understand why the natives say it cries.

Tropical Tree

The hevea needs a humid, hot climate in which to grow. At the beginning of the 18th century, the hevea was imported from the Amazon basin to the Far East, where it was planted on huge plantations.

Harvesting Latex

A hevea tree is not used as a source of latex for the first six years of its life. Then in the next dry season, workers tap the tree by carving slanting cuts in a spiral or V shape in the trunk of the tree. This is done in order to reach the channels of latex circulating under the bark. The latex flows down the slashes into containers until the cut heals. After a rest period, the tree will be tapped again.

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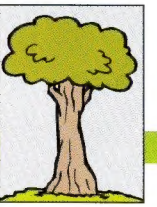
D2 491 05-20

Which cone-bearing tree loses its "leaves" in winter?



PLANTS AND TREES

1 The spruce

2 The larch

3 The sugar maple

©1995 Nintendo

Conifers

Nearly all conifers are evergreens with year-round foliage of green needles or scales. But unlike its pine family relatives, the larch sheds its needles in winter like deciduous trees shed their leaves.

2 The larch is a conifer—cone-bearing tree—that loses its foliage in winter.

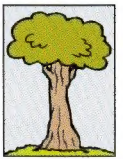


Photo © C. Delu/Explorer

Because conifers grow faster than other trees, they have long been used for building wood and for the wood pulp used in the manufacturing of paper. Today, people try to conserve our giant trees by recycling paper.

Conifers grow in temperate and cold climates and include some of the tallest plants in the world. For example, the California redwood is a conifer that grows as high as 328 feet (100 m) above the forest floor!

Classifying Conifers

You can always identify a conifer because of its shape, its needles, and its cones. For example, the Douglas fir, often used as a Christmas tree, has long, soft needles and cones with pointy scales.

The Larch

The larch's needles grow in clusters on spikelike branches. Its small oval cones are about 1 inch (2.5 cm) long. When they first appear, the cones are bright red. Then they turn darker red and finally brown. In the Eastern U.S. the larch, known as the tamarack, grows to be about 60 ft (18m) high; in the Western U.S. it's about 150 ft (46 m) in height.

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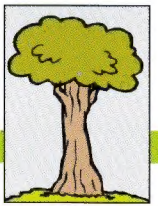
What kind of plant is bamboo?



PLANTS AND TREES

1 Tree
2 Grass
3 Fern

©1995 Nintendo

Bamboo

Bamboo is a tall woody grass, one that grows up to 120 feet (37 m) tall. A speedy grower, bamboo shoots have been known to sprout more than 3 feet (1 m) in just one day! How'd you like to have to cut that kind of grass?

2 Bamboo is a woody grass.

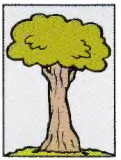


Photo © Tetefolle/Explorer

Bamboo remains green all year long.

Most plants grow out of the ground as slender shoots that become thicker as they grow taller. But bamboo isn't like other plants. When its lance-shaped leaves pop up, they're already on full-grown, mature, hollow stems. that may be about 10 inches (25 cm) in diameter. Then the leaves grow upward like telescopes, stretching further out from the roots.

A Practical Plant

Bamboo grows in Asia, Africa, Australia, and the southern United States. Young bamboo shoots are used for food, especially in Asia where both people and pandas enjoy the savory stalks. More mature stems are cut down and used for the construction of houses and furniture.

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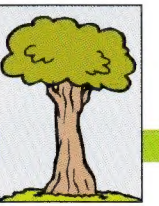
D3 491 07-01

What kind of plant is a saguaro?



PLANTS AND TREES

1 A pine tree

2 A cactus

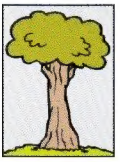
3 A hanging vine

©1995 Nintendo

Saguaro

The saguaro, also known as the giant cactus, grows only in the desert foothills of Arizona, California, and Mexico. It's the largest cactus found in the U.S.

2 A saguaro is a cactus.



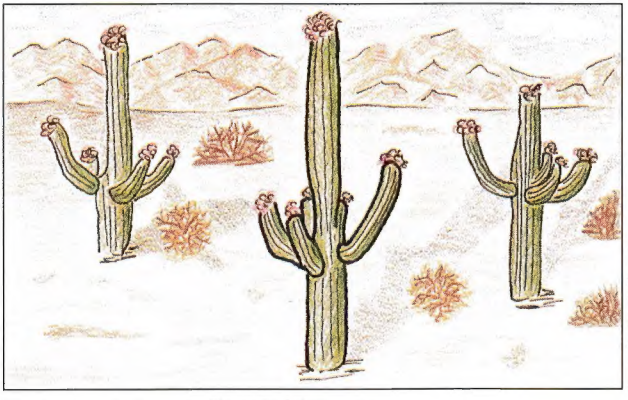


Illustration © Mimi Perroni

The saguaro is the state flower of Arizona.

There are 2,000 species of cacti. Most, like the saguaro, thrive in dry, hot regions. This desert giant grows to be 60 feet (18 m) tall and to weigh 10 tons (9 metric tons).

The Bare Tree Look

The saguaro looks somewhat like a bare tree, with its 1- to 2 1/2-foot (30- to 76-cm) thick columnlike trunk and long upturned branches. The plant's roots, about 50 feet (15 m) long and close to the desert surface, soak up and store what little rain falls. Grooves and ridges (ribs) run from top to bottom on both the saguaro's trunk and branches. They expand and contract depending on how much water is stored in the plant. Waxy, green-white flowers and edible red fruit grow from the pad-like structures near the tips of the trunk and branches. The funnel-shaped 3-4 inch (7.6-10 cm) flowers bloom at night.

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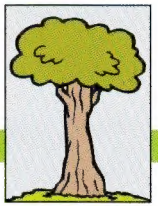
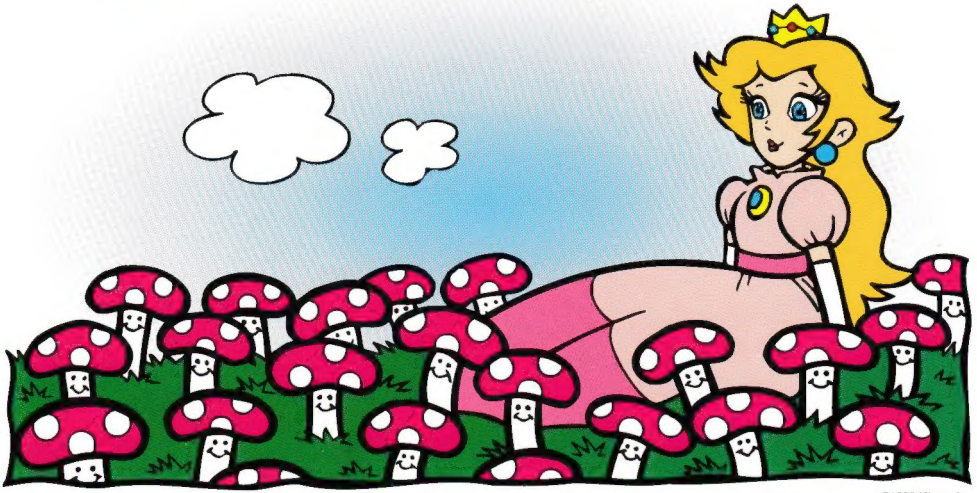
D3 054 08-08

What is a mushroom?



PLANTS AND TREES

1. A green plant
2. Fungus
3. A lentil



©1995 Nintendo

Mushroom

Mushrooms are not plants. They belong to a separate subkingdom of living things called *Thallophyta,* that includes algae, fungi, and bacteria.

2 A mushroom is a fungus.

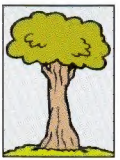


Photo © Chaumeton / Jacana

Mushrooms are fleshy, umbrella-shaped fungi that belong to the same subkingdom as the bacteria used to make some antibiotics.

There are 3,300 species of mushrooms. They grow in wooded and grassy areas, and survive by absorbing food from living or decaying plant life around them.

Parasites

Because mushrooms contain no chlorophyll, they can't use sunlight to convert carbon dioxide from the air and water into food (photosynthesis), as plants do. Instead, they must absorb necessary nutrients from tree trunks, fertilizer, leaf mold, and even from old paper. So mushrooms are parasites—organisms that feed on a different organism but contribute nothing to the survival of their hosts.

Two Parts

Mushrooms have two parts. The mycelium, just beneath the soil, absorbs food and lives many years. The fruiting body, above the soil, lives only a few days but produces spores from which new mushrooms grow.

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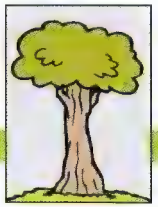
D3 054 08-09

From what kind of plant do we obtain oils?



PLANTS AND TREES

1 An oleaginous plant

2 A textile plant

3 A carnivorous plant

©1995 Nintendo

Oleaginous Plant

The seeds and the fruits of numerous plants are oleaginous and provide edible oils. Most of the fats and oils in people's diets come from plant sources.

1 **An oleaginous plant is one that yields oil, like sunflower oil.**

Photo © Nacivet / Explorer

Sunflowers planted in April are harvested in September, when they are heavy with seeds.

Sunflowers, corn, peanuts, and soybeans are a few sources of nutritious oil. Walnuts and olives are also processed to supply oil. Castor oil and linseed oil are used in the production of chemicals, plastic materials, paint, varnishes, and printing inks. The oil of sweet almonds is medicinal.

Processing Oils

First the seeds of the plants are husked—the outer covering is taken off. Then the husked seeds are ground and heated to remove some of the water in them. Next, they are squeezed to release the "raw oil" from the pulp. After this process, the pulp that contains the oil is pressed again, then distilled and refined. Finally, it's ready for consumption. Plant oils are high in calories and are part of everyday diets all over the world.

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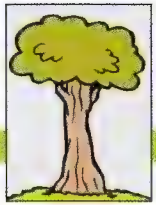
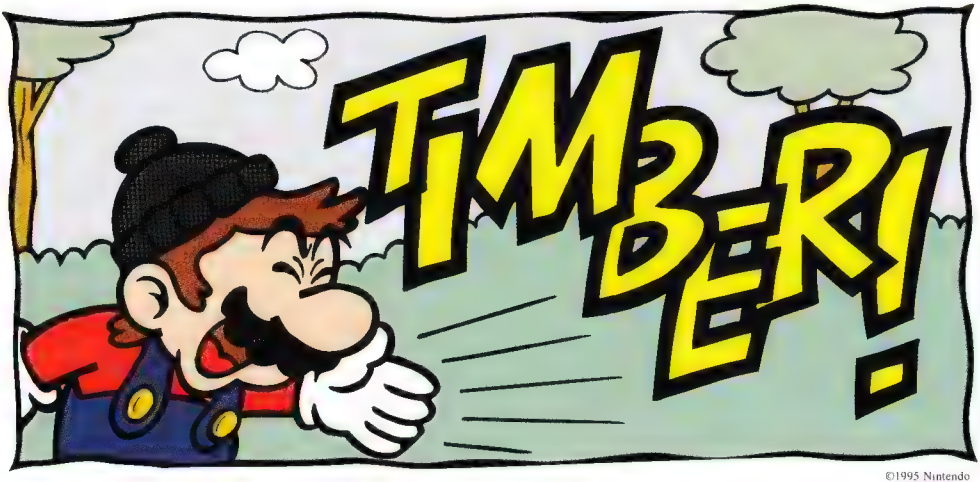
D3 054 09-04

When do people yell *"TIMBER!"*?



PLANTS AND TREES

1. When a tree's about to fall
2. When they spot a fire
3. When they see a two-masted schooner



©1995 Nintendo

Logging

When a lumber worker shouts "TIMBER!" you'd better watch where you're walking. The shout is a warning to keep you from stepping in the path of a falling tree.

1 People yell "TIMBER!" when a tree's about to fall.

Photo © Roy / Explorer

Modern lumber workers fell trees and cut them into pieces with gasoline-powered chain saws.

Someone about to fell a tree usually slashes a notch in the tree trunk, perpendicular to the direction in which he or she wants the tree to fall. Then the lumber worker saws the remaining section, taking care to leave a strip of wood intact as a sort of hinge to help lower the tree during its final plunge to the ground. A quick call of "TIMBER!" and the tree crashes to the ground.

Transporting Trees

Over the years, different methods have been used to carry the felled trees from the forest to the sawmill. Sleds and wagons pulled by oxen have been used. Most often the logs were floated on a river, a system that's still used today. Whenever possible, the trees are cut up into pieces or long boards in the forest to avoid transporting the huge logs.

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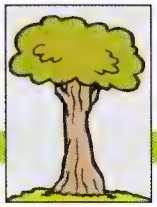
D3 054 10-11

What tree has white bark?



PLANTS AND TREES

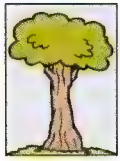
1 Beech
2 Peach
3 Birch

©1995 Nintendo

Birch

The birch tree is easy to identify because of its silver-white bark. This bark becomes black and cracked as the tree ages.

3 **The paper birch tree has white bark.**



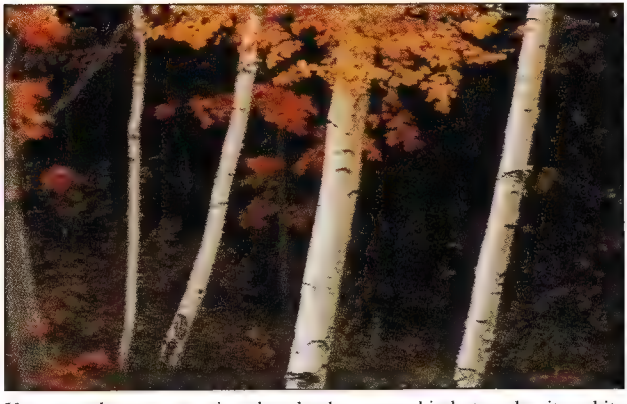


Photo © Jim McElholm / Vermont Department of Travel & Tourism

You can always recognize the slender paper birch tree by its white peelable bark.

There are 40 species of birch trees in North America, Europe, and North Asia. Paper birch, native to North America, has thin white bark that peels in horizontal layers, almost like paper.

Pioneer Tree

Paper birch can survive in very poor soil where other trees cannot grow. It puts down roots in clearings and areas that have been leveled by fire, and endures cold weather well. Not only is it a hardy and handsome tree, it's also a useful one. The wood is strong and beautiful—perfect for making furniture and wood veneer. The wood pulp is used to make paper.

Canoe Birch

White birch grows to be 60-80 feet (18-24 m) tall. It's also known as canoe birch because North American Indians used its bark to make their birch canoes. The wood contains so much resin, it's almost waterproof. Today, Indians still use paper birch bark for baskets and other crafts.

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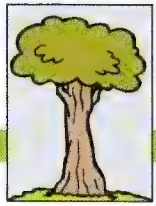
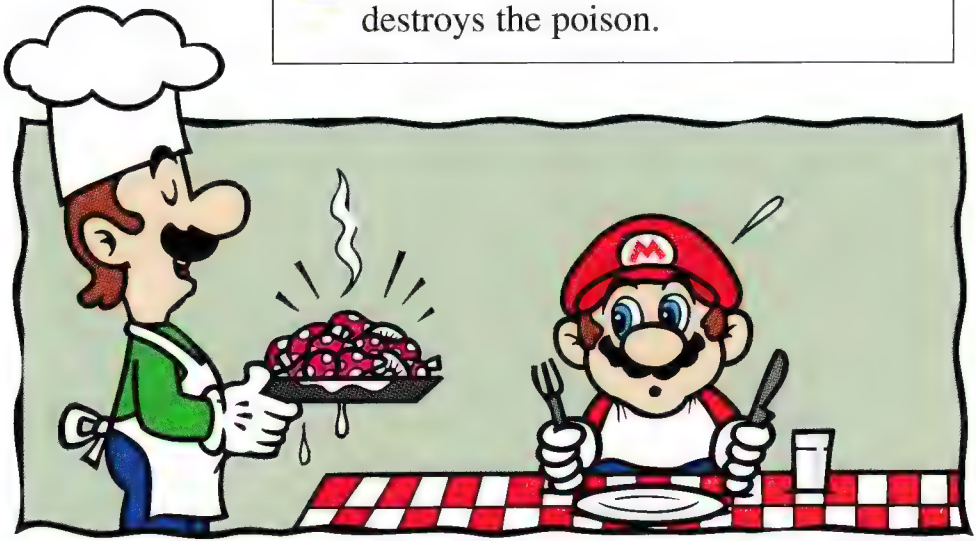
D3 054 10-12

Can you eat toadstools?



PLANTS AND TREES

1. Yes, they are just a type of mushroom.
2. No, they are poisonous mushrooms.
3. Yes, they are poisonous but cooking destroys the poison.



©1995 Nintendo

Toadstools

Toadstools are mushrooms that are either poisonous or have a bad taste. There are more than 2,000 species and there is no simple test to tell the poisonous ones from those that are safe to eat.

2 **You cannot safely eat toadstools because they are poisonous mushrooms.**

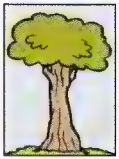


Photo © Le Roy / Jacana

Amanitas are deadly mushrooms. The deadly amanita, *A. phalloides* is usually found in wooded places.

Most toadstools aren't lethal if eaten, but they are likely to make you very sick. For example, the Jack-o'-Lantern toadstool, whose bright orange cap glows in the dark, might give you an upset stomach, diarrhea, or worse. Some toadstools can cause death, and no amount of cooking can get rid of the poison. They damage the liver and kidneys, and unless the eater gets immediate treatment, he or she will die.

Deadly Beauties

Some of loveliest yet deadliest toadstools are known as amanitas. For example, the all-white Destroying Angel is beautiful and the fly agaric has a bright yellow, orange, or red cap with white warts on top. Some people cut up the deadly fly agaric, sprinkle sugar on top, and tempt pesky flies to stop for a meal. The flies land and find instant death!

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Which plant part is the first to sprout above ground?

PLANTS AND TREES

1. The cotyledon
2. The flower
3. The roots

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Cotyledon

The cotyledon is the rough leafy portion of a plant's embryo—the part of the seed from which a mature plant develops. The cotyledon contains the plant's food reserve.

1 **The cotyledon is the first plant part to sprout above ground.**

Photo © Labat Lancean / Jacana

Time-lapse photography allows us to see how the cotyledon, or seed leaves, withers and falls from the seed as the plant develops real leaves.

The cotyledon, also called seed leaves, supplies a "baby" plant its first food. Once the food supply is used up, the cotyledon withers and drops off the plant. After that, the plant receives nourishment from its real leaves and roots. Plants are classified by their number of cotyledons. Monocots are plants with one cotyledon, such as corn, bananas, bamboo, palm trees, water lilies, orchids, and pineapples. Dicots with two cotyledons, include buttercups, beans, roses, sunflowers, cabbage, and squash.

Unusual Cases

In peas, the cotyledons remain underground with the sprouting seed and are discarded before the plant comes up through the soil.

Next time you eat peanuts you can see their cotyledons for yourself. The two halves of the nut are its cotyledons. The rest of the peanut embryo is the small kernel where the cotyledons were attached.

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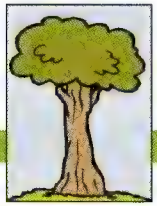
D3 054 15 05

How are a plant's roots used?



PLANTS AND TREES

1. To make the plant grow straight up
2. To anchor the plant and to bring food to it
3. To anchor the flowers in place

©1995 Nintendo

Roots

Like all living things, plants need food in order to grow and survive. They receive all the water and minerals they need from the soil, thanks to their underground root systems.

2 Roots anchor a plant in the soil and bring food from the soil up to it.

Photo © F. Varin / Explorer

Soil erosion uncovered the long root system of this tree.

A plant's roots play an important part in its life. They anchor the plant in the soil so it can stand up to wind and rain. And their tiny hairs soak up the soil's water and minerals—magnesium, potassium, iron, and calcium—to feed the plant.

Ups and Downs

The core of the root is made up of many cells. Some cells carry the water and minerals absorbed from the soil up to the stem and leaves. Other cells transport food down from the leaves for the root to either use or store for future use.

Root Types

Some plants have a taproot system, with one large primary root and many small secondary roots. Other plants have a fibrous root system, with many slender roots, all about the same size, growing out in all directions. And some plants, like corn, have special prop roots above ground to brace the plant against the wind.

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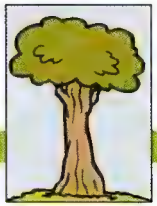
D3 054 15-06

Which plant parts are used to make perfume?



PLANTS AND TREES

1. Only the flower petals
2. The buds, leaves, petals, and stems
3. Only the stems

©1995 Nintendo

Perfume

Flowers secrete odors to attract insects. Fragrances of some plants are also used to make perfume for humans.

2 Buds, leaves, petals, and stems are used to make perfume.

Photo © C d'Hotel / Explorer

The specialist who picks the essences to include in a new perfume is called a "nose."

Each sweet-smelling plant has a tiny baglike sac which stores essential oils that provide a pleasing odor. The sacs are located in different parts of the plant, depending on the species. In roses and jasmine the flower petals are the most fragrant part of the plants. But pleasing scents also come from the leaves of geraniums and mint; roots of iris and ginger; rinds of lemon and orange; and buds of clove. Oils from flower petals have the most delicate scent, those from other parts of the plant are usually stronger and spicier.

The "Nose" Knows

The oils are extracted from the plants by steam distillation. If a perfume maker wants a new scent, he or she asks a nose—an expert who can tell which odors, mixed together, will create a sensational smell.

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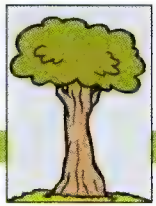
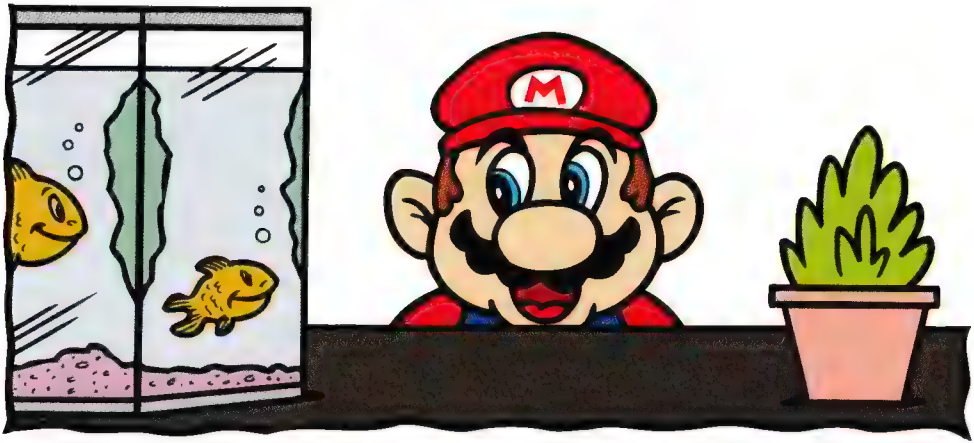
How do algae differ from other plants?



PLANTS AND TREES

1. They have no chlorophyll.
2. They have no roots, stems, leaves, nor flowers.
3. They have no nutritional value.



©1995 Nintendo

Algae

Unlike other plants, algae have no flowers, roots, stems, nor leaves. Some algae are microscopic, with only one cell; some are large, with many cells.

2 Algae differ from other plants because they have no roots, stems, leaves, nor flowers.

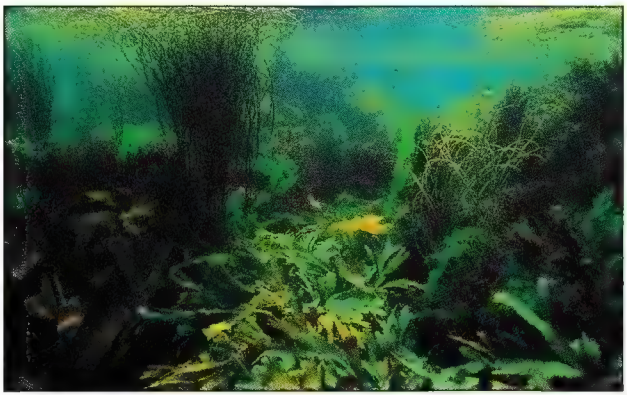


Photo © M. Le Coz / Explorer

This underwater photo shows a variety of marine algae.

Algae live in oceans, rivers, ponds, creeks, moist soil — anywhere there's water and sunlight. Algae needs light because, like other plants, algae contain chlorophyll, used to make food through the process of photosynthesis. That process also helps purify the air in water, but some algae multiply quickly and can upset the balance of life in water. If algae increase too much, the water's oxygen level becomes extremely low and unfit for use by people or animals.

Colorful Classes

Brown algae are found in the ocean and along beaches. Kelp, a brown algae, can grow 200 feet (61 m) long. Green algae thrive in salt and fresh water. Large amounts of microscopic green algae can color a whole pond. Red algae grow mainly in subtropical seas, along with coral. The Japanese eat nori, a kind of red algae that dries in paper-thin sheets.

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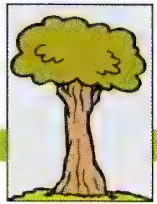
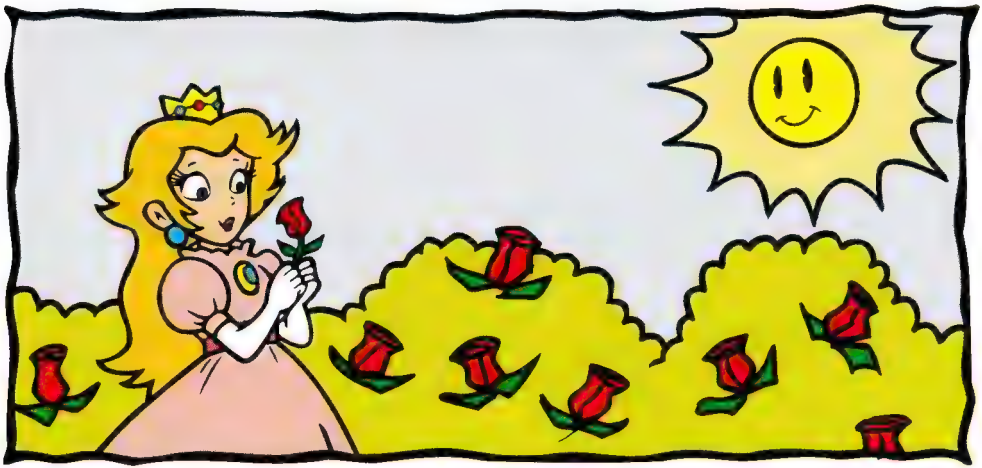
What is chlorophyll?



PLANTS AND TREES

1. Gas that a plant breathes
2. Pigment that makes a plant green
3. Scent of a plant



©1995 Nintendo

Chlorophyll

Chlorophyll is the pigment that makes plants green. Even red, brown, or yellow plants contain chlorophyll—it's hidden by other pigments. Chlorophyll also helps plants create their food.

2 Chlorophyll is a pigment or coloring matter that gives a plant its green color.

Photo © Abel Lhoir / Sipa Icono

Leaves have more than one pigment. The color we see depends on the amount of pigment. Green leaves have more chlorophyll or green pigment.

Using a process called photosynthesis, plants make their own food to enable them to survive. Chlorophyll is vital to the process.

Energy Exchange

Any synthesis or manufacturing process requires energy. The chlorophyll absorbs energy from sunlight and converts it into chemical energy that powers a plant's photosynthesis. Using nitrogen from the soil, carbon dioxide from the air, water, and sunlight, the plant produces starches, sugars, and other nutrients it needs to live and grow. So without sunlight, there would be no plants. Many scientists believe that millions of years ago a giant dust cloud, created when a meteorite hit Earth, blocked the sun and all plant life died. Then plant-eating dinosaurs died, as did meat-eaters—all because chlorophyll couldn't do its job!

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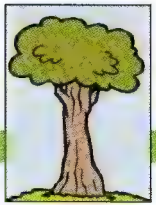
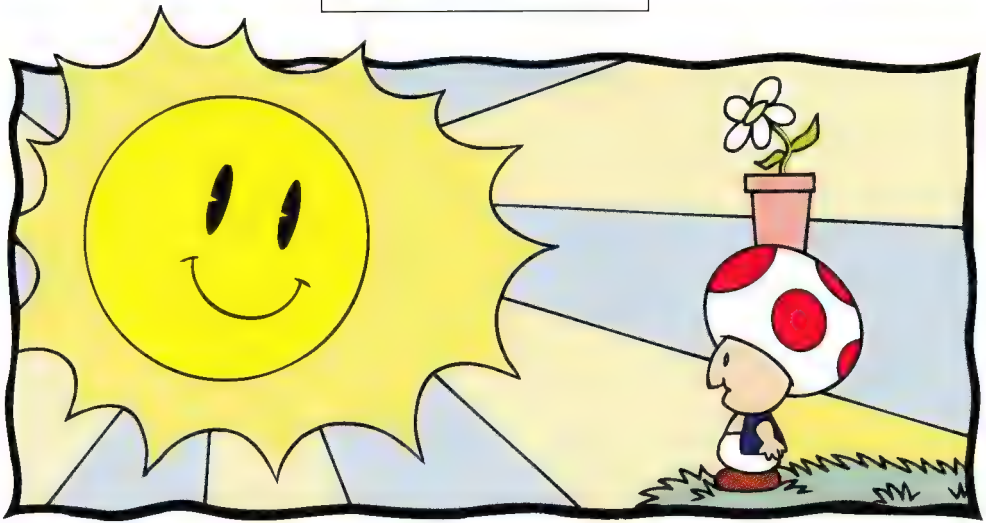
In which plant part does photosynthesis occur?



PLANTS AND TREES

1. The wood
2. The leaves
3. The roots



©1995 Nintendo

Photosynthesis

A plant's leaves contain chlorophyll, a green pigment necessary in the process of photosynthesis. The main function of the leaves of a plant is the making of its own food through photosynthesis.

2 Photosynthesis takes place in the leaves of a plant.

© M. Moisnard / Explorer

Leaves, because of their construction and location, receive the maximum amount of the sunlight, which is necessary for photosynthesis.

Photosynthesis requires energy. The word photosynthesis means "put together with light," and that's just what the leaves do. The chlorophyll in a plant's leaves absorbs energy from sunlight, then transforms it into chemical energy through photosynthesis. At night, with no sunlight available, the leaves can't carry out photosynthesis and most plants enter a resting state until dawn.

The Process

The photosynthesis process uses sunlight, carbon dioxide from the air, and water and minerals brought up from the soil. A plant's leaves combine these ingredients to produce the sugars, starches, and other nourishment the plant needs to live and grow. During photosynthesis, the leaves give off into the air oxygen that animals and people breathe.

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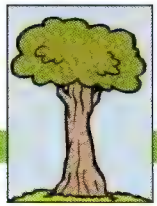
From which part does a tree grow?



PLANTS AND TREES

1 The roots

2 The leaves

3 The buds

©1995 Nintendo

Buds

Each year, the tip of each branch and the trunk of a tree develop buds. It's from these buds that the tree grows taller.

3 A tree grows from its buds.

© S. Cordier / Explorer

Chestnut, poplar, and conifer buds are covered with resin, excreted by their protective coatings to provide maximum protection.

Wrapped in a protective covering of bud scales, each bud contains a tiny, green, leafy stem called a shoot. When the bud opens, the shoot begins to grow and make the trunk and branches taller.

Bud Growth

When spring comes in areas with a cold climate, the temperatures are warmer and days longer, bringing more hours of sunlight. The gentle rain showers bring warm moisture. The buds on trees begin to swell from the moisture and warmth. Then each opens, allowing its shoot to stretch out and grow longer.

Bud Types

Some tree buds grow into flowers. Others form twigs that produce both flowers and leaves. Other buds grow on the sides of the trunk and branches. The shoots of these buds develop into leaf-bearing twigs that eventually become new branches.

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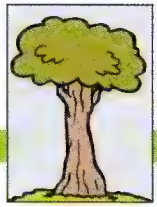
What is pollen?



PLANTS AND TREES

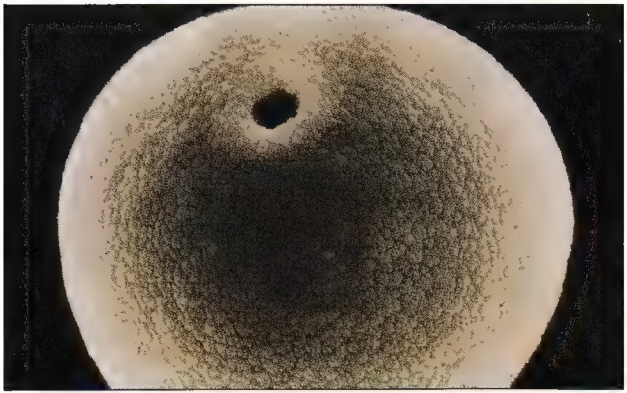
1. A sticky substance on coral
2. The male element of plant fertilization
3. Cat food

©1995 Nintendo

Pollination

Pollination is the first step toward fertilization, by which a plant reproduces. The male and female elements of the plant must combine to fertilize and produce seeds and flowers.

2 Pollen is the male element necessary for plant fertilization.



© F. Durand / Sipa Press

A grain of pollen seen through a microscope. As the stamen, or male part, discharges the pollen, it sometimes creates a dustlike cloud.

Pollen, powderlike cells, is ejected from the stamen, or male part, of a flowering plant. To fertilize the plant, the pollen must reach the pistil, or female part, of the plant. The pollen may fall directly on the pistil of the same flower, or it may be transported to other flowers by various means, including being carried by the wind. This can cause distress to people who have allergies to pollen.

Other Pollen Movers

Besides the wind, pollen may be carried by water or by insects. Bugs, especially bees, are attracted to flowers by their bright colors and the fragrant odor of nectar. If a bug lands on a flower, the powdery pollen sticks to its body. Then, when it flies off and lands on another flower, the pollen may rub off the insect onto that flower, and fertilization will begin.

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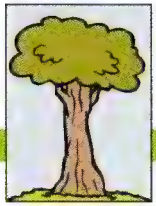
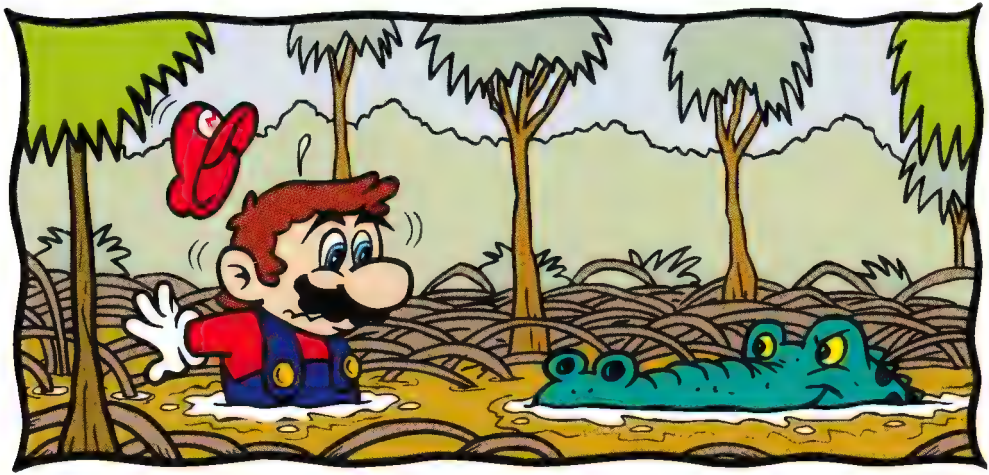
What is a mangrove?



PLANTS AND TREES

1. A fishing spot for men only
2. A tree that grows in salty ocean water
3. A mango plantation

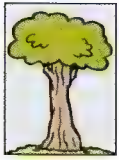


©1995 Nintendo

Mangrove

A mangrove tree grows in salty ocean water, usually in bays and lagoons. This evergreen sends down roots from its branches, and in time a network of stiltlike roots support the tree above water.

2 **A mangrove is a tree that grows along tropical coastlines in salty ocean water.**



© P. Labonte / Explorer

The mangrove's tangled roots snag sediment and pile it up to build up the land.

Mangrove trees, native to tropical and subtropical coasts and swamps, grow in various sizes. Some are not much bigger than bushes, while others may grow 82 feet (25 m) tall.

More Mangroves

When fruit from a mangrove tree falls into the water, seeds in the fruit send down roots up to 1 foot (30 cm) long. The roots imbed themselves in the mud and a new tree starts to grow. As more seeds become imbedded in the mud, they create a mass of tangled plant growth. Large mangrove thickets look like strange forests on stilts!

Helpful Growth

The mangrove's stiltlike roots slow down the water's current and capture any sediment in the water. As the sediment collects, it begins to form dry land. The roots also provide breeding grounds for fish and marine life in the area.

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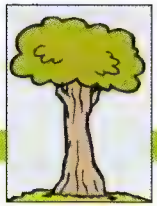
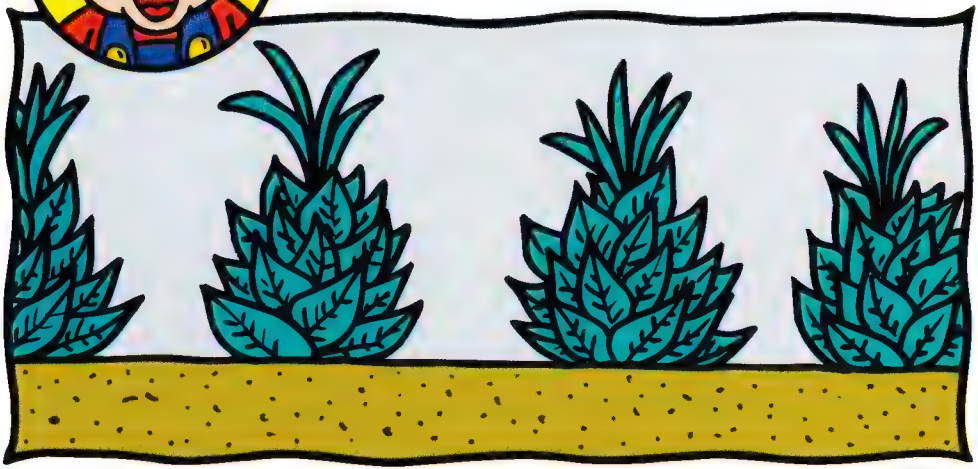
Where did tobacco originate?



PLANTS AND TREES

1. In Egypt
2. In Europe
3. In the Americas



©1995 Nintendo

Tobacco

Native to the Americas, tobacco was introduced to Europe by Christopher Columbus, who brought it back from his journey to the New World. Soon tobacco was popular worldwide.

3 **Tobacco originated in the tropical parts of North and South America.**

© Abecasis / Sipa Press

China produces the most tobacco. The U.S. is second, growing 1 million tons (900,000 metric tons) a year.

Indians smoked tobacco long before Columbus encountered them in 1492. He took back some seeds when he returned to Europe, where tobacco was later grown as medicine—to help people relax and to cure headaches. Tobacco became a commercial product in North America in 1612 when English colonist John Rolfe, future husband of Pocahontas, brought some tobacco seeds to Virginia from South America. Today, it's a cash crop in more than 60 nations.

Gathering Tobacco

The tobacco leaves are plucked then dried in the sun or a drying room. Next, the leaves are gathered into bunches and hung to cure, or mellow. Then they're rolled into cigars or chopped for pipe tobacco or cigarettes. Leaves of different plant varieties are blended to achieve pleasing taste and aroma.

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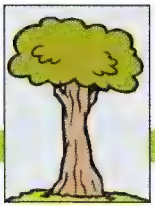
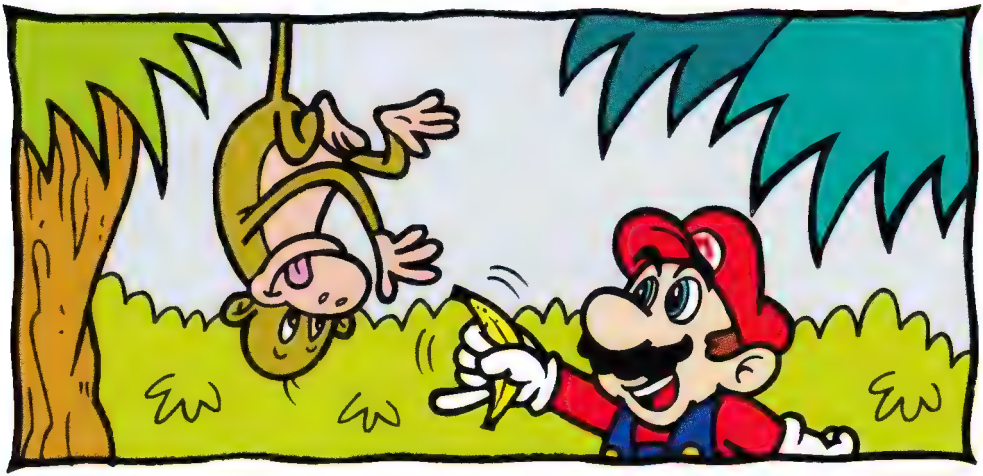
In which climate do bananas grow?



PLANTS AND TREES

1 Tropical
2 Dry
3 Polar



©1995 Nintendo

Bananas

Bananas grow on tropical plants 8-30 feet (2.4-9 m) tall. They resemble trees, but they don't have woody trunks or branches. These plants produce delicious edible fruit.

1 Bananas grow in places with tropical areas.

© A Pena / Sipa Press

Bananas are harvested while still green so they can ripen and be fresh when you buy them at the market.

Bananas grow in warm, damp climates with rich sandy soil. Originating in Asia, bananas now grow in tropical areas of both the Eastern and Western Hemispheres. Brazil leads the world in banana production, followed by Uganda and India. Latin America supplies over 90 percent of the 11 billion bananas Americans eat yearly.

Growing Bananas

Growths, called suckers, are cut from the undersides of mature banana plants. The suckers are planted, and in 3-4 weeks sprout tightly rolled leaves. The leaves unroll and grow to be 6-10 feet (2-3 m) long, looking like big drooping feathers. In 10 months, large buds appear, producing clusters, or hands, of 10-20 bananas. Each plant produces five hands of bananas.

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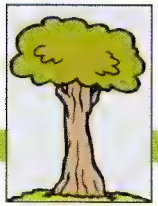
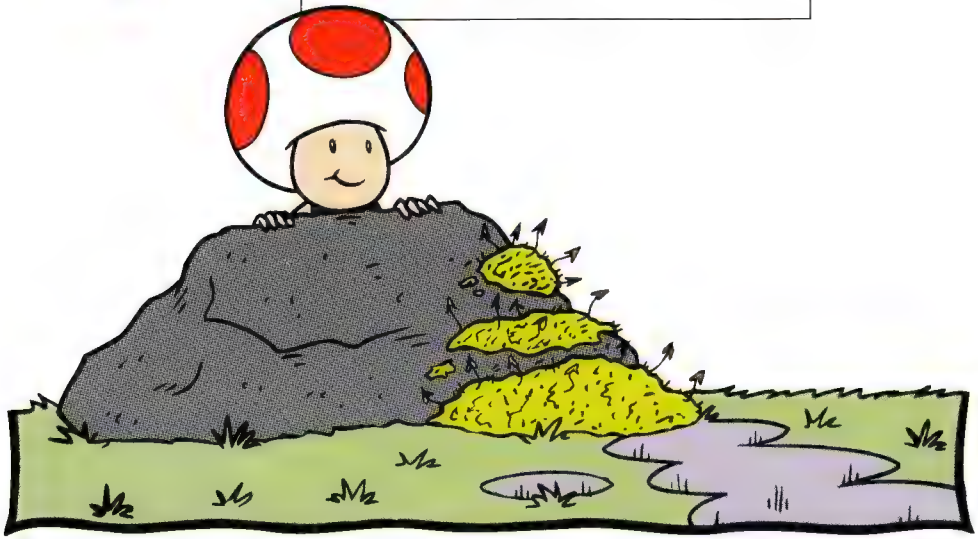
How does moss absorb water?



PLANTS AND TREES

1. Through the roots
2. Through the entire plant
3. Through the flowers



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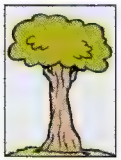
Mosses

Mosses are nonflowering plants that have no roots to absorb water. They get water by assimilation: it spreads through the entire plant, like in a sponge.

2 Moss absorbs water by assimilation through the entire plant.



© Geoghegan k. / Sunset

Two common mosses are granite moss, found on rocks in mountain regions and the Arctic, and peat moss, found in bogs and marshes.

There are 10,000 species of mosses, or bryophytes, small plants which first appeared on Earth during the Paleozoic period, about 395 million years ago. They thrive in damp places, often growing in thick, soft carpets on soil or fallen trees. Each individual moss has a stem with spirals of leaves at the bottom, and hairlike rhizoids anchoring it to the ground. Rhizoids aren't roots; they don't absorb or transport water. They act only as anchors. Water is slowly diffused through mosses from the dampness around them. If water is scarce, mosses turn brown and appear dead. But with just one rain shower, the plants revive.

Ecological Helpers

Mosses grow successfully in areas where other plant life is sparse. Settling on bare soil and growing low to the ground, mosses help stop soil erosion.

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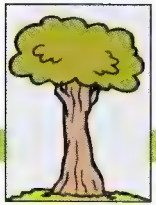
Which is the art of growing miniature plants?



PLANTS AND TREES

1 Topiary

2 Bonsai

3 Hydrangea

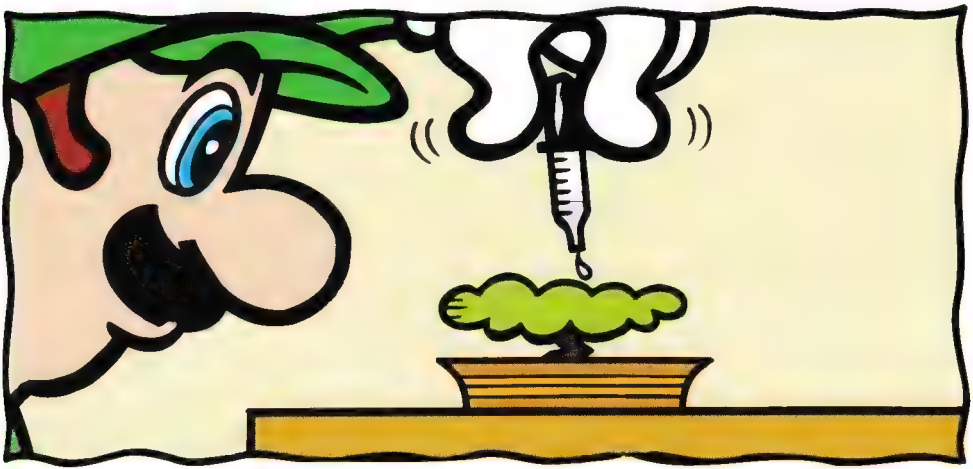


Illustration Gary Fields

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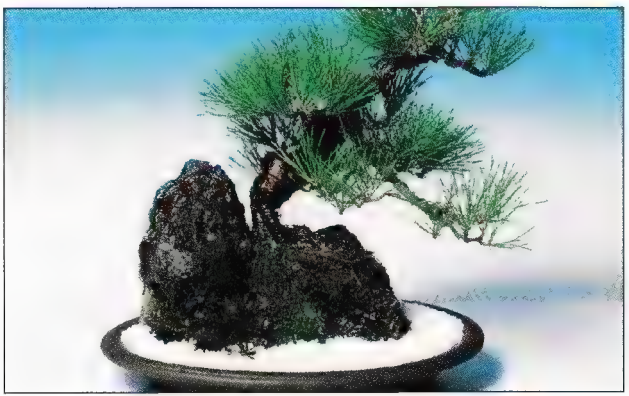
Bonsai

"Bonsai" is Japanese for "bowl cultivation," and that's how bonsai plants are grown—in bowls or other containers. Plants are kept small by careful pruning.

2 **Bonsai is the art of growing miniature trees and other plants.**



© Japack / Sunset

A bonsai miniature scene reflects the quiet, powerful beauty of nature.

Bonsai gardening originated in China centuries ago—some bonsai trees in China are 1,000 years old. The hobby spread to Japan, where you'll find specimens over 300 years old. Bonsai was introduced to the U.S. in the early 1900s.

A Small Bit of Nature

Bonsai reflects the Oriental love and respect for nature. A single tree, usually between 2 inches to 3 feet (5 to 91 cm) tall, may be used to represent a forest with a small rock to represent mountains. Small-leafed trees or evergreens are thought best for bonsai because their leaves grow in proportion to the whole plant. Other popular plants are juniper, flowering azalea, cherry, plum, and bamboo. Bonsai plants are pruned repeatedly, new growth is pinched off, and wire is used to bend branches in the desired direction. To create a beautiful bonsai takes time, patience, and effort, but the results can be true works of art.

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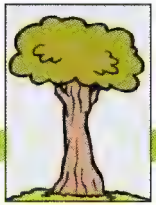
Which has thorns?



PLANTS AND TREES

1 Violets

2 Roses

3 Tulips

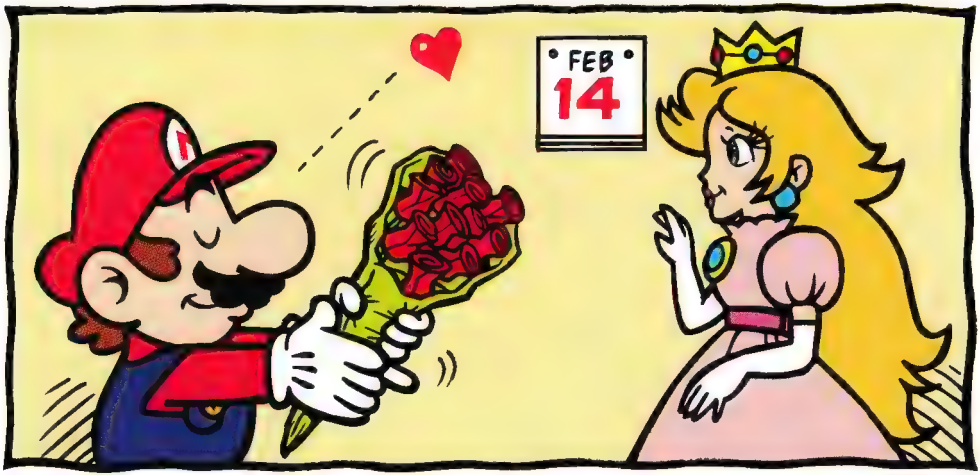


Illustration Gary Fields

©1995 Nintendo

Rose

A rose is any climber or shrub of the Rosaceae family, with a thorny stem and five-parted, sweet-smelling flowers. The thorns protect roses by discouraging animals from eating them.

2 **Roses grow on bushes or vines that have prickly thorns.**

© G. Lacz / Sunset

Roses come in many different colors, including red, pink, white, and yellow. As the flowers open, you can see the five-part petals.

One of the best known garden flowers is the rose. The fragrant flowers grow in northern temperate regions and high elevations southward into Mexico and India. Roses are also among the leading commercial plants grow under glass in hothouses. For centuries roses have been cultivated in Asia and Europe, and many different kinds have been cross-bred to produce new and more beautiful rose varieties.

A Lovely Mistake

They say the lovely American Beauty Rose was really a cross-breeding mistake. One day many years ago, this new rose variety just appeared in the corner of a neglected garden in Washington, D.C. It seems the bees in the area had mixed the pollen of one rose variety with the seeds of another, something that wouldn't have happened had the garden been tended and the insects controlled.

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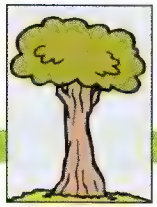
Where did coffee originate?



PLANTS AND TREES

1 France
2 Colombia
3 Ethiopia

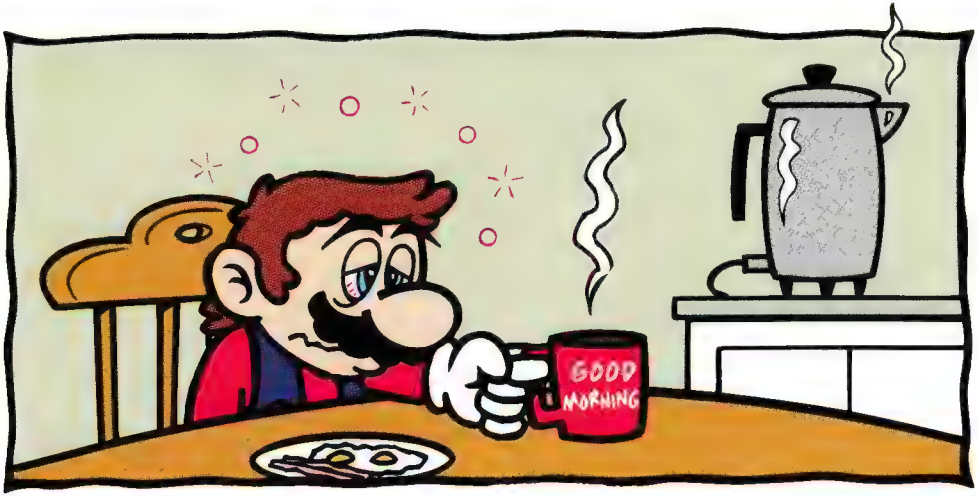


Illustration Gary Fields

©1995 Nintendo

Coffee

It's said that coffee was discovered in Ethiopia when goatherds noticed the animals were awake all night. In searching for a reason, they remembered the goats had been feeding on leaves and berries from a plant—a coffee plant.

3 **Coffee originated in Ethiopia, one of the oldest kingdoms in the world, located between Sudan and the Red Sea.**

© N H P A / Sunset

Fruits of the coffee bush, known as cherries, turn slowly from green to deep red as they ripen.

Coffee came to Arabia in the 1200s, but before it was a beverage, it was a medicine. In the early 1600s, European coffee houses opened, where people gathered for serious discussions. In America, colonists began to drink coffee instead of tea after the Boston Tea Party, a protest against a British tax on tea.

Coffee Facts

Coffee grows on bushes 14-20 feet (4.3-6.1 m) high with glossy leaves and fruit. Each bush produces enough berries a year to make 1.5 pounds (.7 kg) of coffee. In the U.S., people drink 400 million cups a day! There are more than 100 kinds of coffee, most named for the places from which they come. Mocha is shipped from Mocha, Yemen; and Java is from the South Pacific island of Java.

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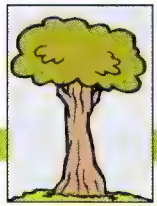
Which is a plant without flowers?



PLANTS AND TREES

1. Funicular
2. Fern
3. Firmament

Illustration. Gary Fields

©1995 Nintendo

Ferns

Botanists believe ferns were among the first plants on Earth. They were here long before flowering plants.

2 A fern is a plant without flowers.

© J. Warden Sunset

Ferns grow everywhere, except deserts and polar regions.

Ferns grow in damp, shady places like forests and ravines, and near waterfalls. They're delicate, leafy, and green. There are about 10,000 species of ferns. Most grow from a single stem which sprouts long feathery leaves called fronds. In spring, when they first emerge from the ground, the fern stems are tightly curled. In this state they're sometimes called fiddleheads because they look like the neck of a violin. The stem gradually unrolls and the leaves fan out. Some fronds can grow 15 feet (4.5 m) long.

Fabulous Ferns

Like many tropical plants, ferns make great houseplants. They're easy to grow and care for, and lovely to look at. The leaves of asparagus fern have tiny needles, similar to pine needles. Staghorn fern sprouts grayish-green leaves that resemble deer antlers. Bracken, a fern commonly found in Europe, is a favorite food of deer and other forest animals. Ferns also provide nourishment to the soil, enriching it for other plants and trees.

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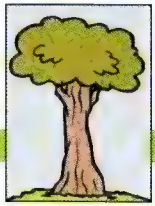
Which is a creeping plant?



PLANTS AND TREES

1 Pyracantha

2 Gladiolus

3 Ivy

Illustration Gary Fields

©1995 Nintendo

Ivy

This hardy evergreen plant lives in cool, moist areas. It creeps and climbs by attaching itself to rocks, walls or trees with suckers or tendrils.

3 Ivy is a plant that creeps and climbs.

© Goetghebuk / Sunset

Ivy creeps and climbs by attaching itself to surfaces with suckers or tendrils.

English ivy is common in the northeastern U.S. It's usually dark green and has five-lobed leaves. Virginia Creeper, also known as American ivy, is another common variety, and there are many others. Some have golden or white-veined leaves, many have leaves shaped like little hearts.

Beware of the Ivy

Poison ivy grows on the ground or as a vine twining up a tree trunk. Contact with poison ivy causes a painful, itchy skin rash in some people. Most poison ivy is easy to identify. It grows in clusters of three leaves and its stem is reddish.

Holly and Ivy

Pagan cultures associated ivy with women, because the plant was fertile and unpredictable—supposedly female qualities. Holly was considered a "male" plant because it was hardy and sedate. The two were planted together to bring luck to men and women in a household. The Christmas custom of decorating the home with holly and ivy descended from this tradition.

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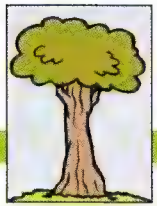
Which is the primary tree of the tropics?



PLANTS AND TREES

1 Palm

2 Pine

3 Pecan

Illustration, Gary Fields

©1995 Nintendo

Palms

Palms are native to tropical regions. Some, like rattan palms of Southeast Asia, are climbing vines that attach themselves to other trees. But most have long slender trunks with a burst of leaves, or fronds, at the top.

1 **Palm trees grow in tropical regions all over the world.**

© J.-M. Fichaux / Sunset

Their big, green crowns of leaves make palm trees easy to recognize.

Some palm leaves are fan-like, measuring from 1 foot long (30 cm) and 2 to 4 feet wide (62-120 cm). Others are very long and feathery, measuring 20 feet long (600 cm) and 1 to 4 feet wide (30-120 cm). Some palms produce fruit. Date palms grow in hot, dry climates like the Middle East, North Africa and the deserts of southern California. Coconut palms prefer the humidity of the South Pacific.

Precious Palms

Palms are an important economic resource to their regions. Besides the commercial harvest of fruit, palms also yield the raw materials for basket-making and some furniture construction. Raffia, made from the leafstalks of some palms grown in Japan and Madagascar, is used to weave baskets and mats. Rattan, from reedy stems of Southeast Asian palms, is used to make furniture, umbrella handles and walking sticks.

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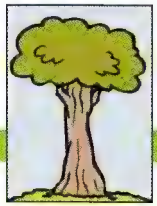
What is tundra?



PLANTS AND TREES

1. Cold, dry, treeless regions
2. Metal used in lamp filaments
3. A new model of car

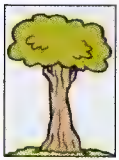
Illustration, Gary Fields

©1995 Nintendo

Tundra

Even in the summer the ground in the tundra is frozen. This permanently frozen soil is called permafrost. But in warmer months of the year the top layers of soil thaw, allowing grasses and low shrubs to grow.

1 Tundra is a cold, dry region where trees cannot grow.



© Animals Animals / Sunset

In summer the tundra is covered with tall grass and low shrubs, perfect grazing for caribou, reindeer and musk oxen.

There are two types of tundra: alpine and arctic. Alpine tundras are located on mountains at altitudes that are too cold for trees to grow. Flat arctic tundras are more common; they're located near the Arctic Ocean. Greenland is almost entirely tundra, as are northern parts of Alaska, Canada, and Russia. The two primary characteristics of tundra are temperature—in the hottest days of summer it only reaches about 54°F (12°C)—and it has no trees.

Tundra Wildlife

Caribou, reindeer and musk oxen roam the tundra prairies in summer. Tundra wolves prey on these animals. Grizzly and polar bears, arctic foxes and arctic hares live in the tundra too. In winter some of these animals migrate south, others hibernate, and others remain active. Seals and walruses live on the coasts, and geese and terns build their nests on the tundra every spring.

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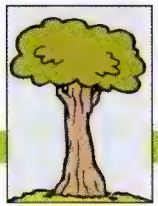
Which plant parts do we eat?



PLANTS AND TREES

1. Roots, tubers, leaves, seeds, bulbs, fruits and flowers
2. Roots, stems, and leaves only
3. Leaves, seeds, and flowers only

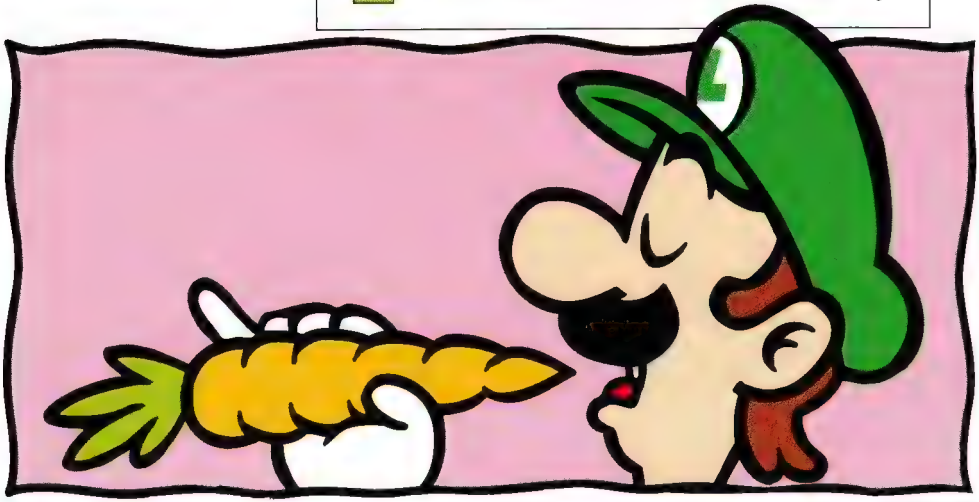


Illustration Gary Fields

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Vegetables

Since prehistoric times humans have eaten different plants. Over time, people have discovered that certain parts of particular plants are not only edible and nutritious, they are delicious!

1 **We eat the roots, tubers, stems, leaves, seeds, bulbs, fruits, and flowers of certain plants.**

© Len Sirman

Colorful, mouth-watering vegetables add vitamins, minerals, and fiber to your diet.

Have you ever eaten the roots of a plant? If you eat carrots, beets, or radishes, the answer is "yes." Broccoli is actually a bunch of flower stalks topped with clumps of buds. Spinach, cabbage, and lettuce are leaves, asparagus is a stem; and garlic, onions, and leeks are bulbs. Eggplants and cucumbers hold the plant's seeds. Peas and lima beans, called legumes, are examples of edible seeds or seed pods.

Tasty Tubers

Tubers are plants with underground stems people eat as vegetables. In moderate climates, the potato is the most important tuber. Yams, cassavas, and taros are tropical tubers.

Vitamin-Rich Foods

Vegetables are full of vitamins, minerals, and fiber. Nutritionists suggest you eat three or four servings of veggies every day.

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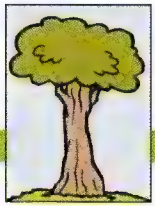
In which area would you find cactus?



PLANTS AND TREES

1. Rain forest
2. Alaska
3. Desert
4. All of the above

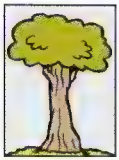
Illustration: Gary Fields

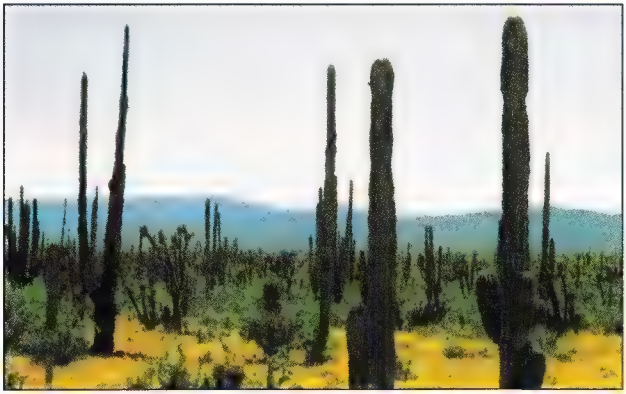
©1995 Nintendo

Cactus

There are approximately 2,000 species of cactus. Most thrive in dry, hot areas like our southwestern states and Mexico, but some grow on mountains, in rain forests, in Alaska, and near Antarctica.

4 Most cacti grow in hot dry areas, but some are found in rain forests and in Alaska!





© Ancelier / Sipa Press

These cacti in the dry, hot climate of the southwestern U.S. can grow to be 66 feet (20 m) tall.

It's believed that, at one time, the cactus was treelike, with branches, leaves, and a woody stem. To survive in dry climates, the stem became softer to absorb and store water. The plant developed a waxy skin to keep water from evaporating—the skin could expand or contract, depending on how much water was stored inside. And its roots grew very long and close to the surface to collect and store as much water as possible.

More Help From Nature

Clusters of spines grow from small lumps, or areoles, on a cactus stem. The spines stop animals from eating the cactus. On some cacti, flowers grow from the areoles. Some open only at night and most bloom only a few days—another way the cactus saves water. A cactus usually grows about 3-4 inches (7.5-10 cm) a year, and can live 50-200 years.

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Which are berries?

PLANTS AND TREES

1 Blueberries

2 Tomatoes

3 Both

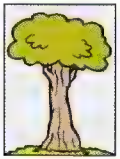
Illustration Gary Fields

©1995 Nintendo

Berries

What are berries? Blueberries, tomatoes, grapes, bananas, oranges, and melons are berries. But some things we think of as berries aren't, like strawberries, raspberries, and blackberries!

3 Both blueberries and tomatoes are berries, fruits with seeds enclosed in soft, juicy pulp or flesh.



© Len Sirman

Some berries, drupes, and other fruits are very colorful. They attract animals to eat them, then scatter the seeds away from the parent plant.

Most people call any small fleshy fruits with many seeds berries. But botanists define a berry as "a small, simple fruit, or seeds in a fleshy substance enclosed by a skin." Sometimes drupes or stone-fruits, which have a single, stony seed-containing pit, or seed, are mistakenly called berries. For example, cherries and peaches are drupes; blackberries are made up of many small drupes, or drupelets.

What's a False Fruit?

A plant's fruit is its ovary or seed-holding part. Botanists define a false fruit as one that doesn't develop from a plant's seed-holding part. For example, the strawberry is a false fruit. It develops from the swollen, juicy stem, and has the plant's true fruits, or seeds, on its surface.

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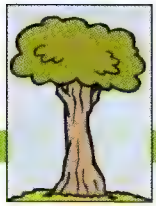
Which are dried grapes?



PLANTS AND TREES

1. Figs
2. Raisins
3. Prunes

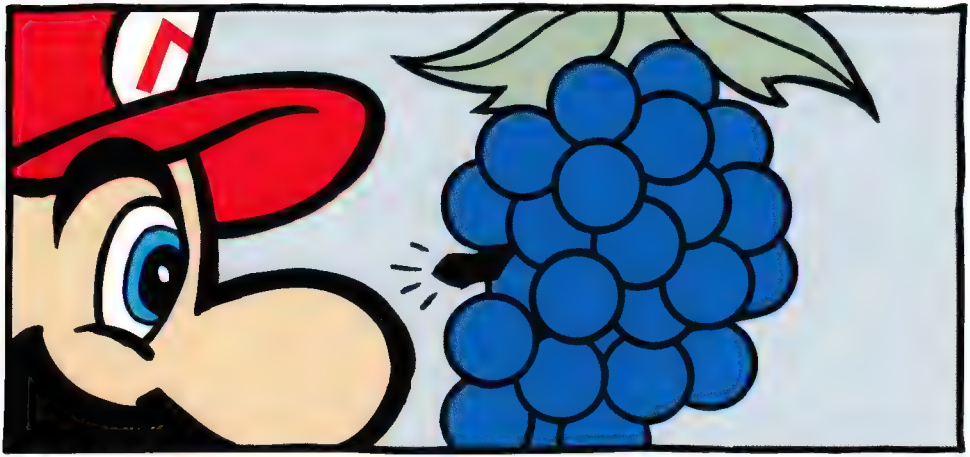


Illustration: Gary Fields

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Grapes

Grapes are juicy, smooth-skinned berries that grow in clusters on woody vines. When dried in the sun or artificially dried, grapes become raisins.

2 **Raisins are dried grapes.**

© Len Sirman

The high natural sugar content of grapes makes them a good source of energy; as well a healthy snack.

Prehistoric fossils prove that grape growing is an ancient art. Today, more than 71 million tons (65 million metric tons) of grapes are raised worldwide each year. Most are grown in France, Italy, Spain, or California, which accounts for about 90 percent of the U.S. grape crop. About 80 percent of all grapes harvested end up as wine, 13 percent as table grapes (fresh fruit), and the remainder dried into raisins, used in jelly and jam, or canned.

Colorful Clusters

Grape clusters may have as many as 300 berries or as few as 6, and depending on the variety, may be purple, green, black, blue, golden, red, or white. In the U.S., large purple Concord grapes are most familiar. They're eaten as fruit and used in jelly, jam, juice, and wine. Emperor, Tokay, and Flame Seedless grapes are red, and the seedless Perlette is greenish-white.

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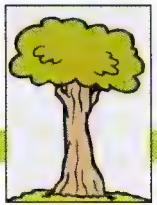
How did the weeping willow get its name?



PLANTS AND TREES

1. Sap drips from its leaves
2. Long hanging branches give it a sad look
3. Water droplets roll down its trunk

Illustration: Gary Fields

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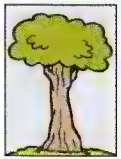
Weeping Willow

Long drooping branches covered with slender delicate leaves which look like falling tears characterize the weeping willow.

2 **The willow's long flexible branches hang low thereby giving the tree a sad look.**



© Len Sirman

Weeping willows are often found in parks by the water.

There are several types of willows. Some are shrubs and others are trees. Most of them grow in cooler northern climates. Besides being ornamental trees and great providers of shade, willows are also used for erosion control and timber. Twigs from the shrubs and young branches from the willow trees are used for basket-making. Pussy willows are the members of the willow family which have soft dark brown catkins—the flower clusters growing in long circular rows along the stalk—that appear before the leaves in early Spring.

Water lovers

Because of its preference for humidity the weeping willow is often found close to rivers, lakes, or swamps. It is said that these willows are hybrids which originally came from East Asia and were introduced as a very fashionable addition to the fancier gardens towards the end of the 18th century.

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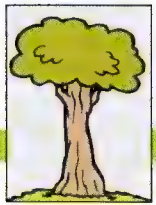
What do you call dried coconut meat?



PLANTS AND TREES

1. Coca
2. Cola
3. Copra

Illustration Gary Fields

©1995 Nintendo

Coconut palm

The coconut palm has a thin trunk and grows by the seaside in tropical countries. Many useful products are made from coconut palms.

3 Dried coconut meat is called copra.

© Len Sirman

Every part of the coconut tree is useful.

In tropical regions, coconut leaves are used to cover huts, make rugs, mats, baskets, and hats. The leaves are even used for irrigation waterways. The fibers or husk surrounding the coconut are braided and used to make things like rope and shoe soles. Indonesians are said to have used the coconut roots as toothbrushes.

A Valuable Nut

The coconut fruit itself contains a sweet-tasting milk which is a popular drink and cooking ingredient. Dried coconut meat, or copra, is used to make oil for cooking or tanning, soap, and oil-cakes to feed animals.

People eat the pulp as is, or grate it for cakes, salads, and other dishes. Wine is made from the sweet juice of the flowers.

And on hot sunny days, a coconut palm can provide cooling, soothing shade for people and animals in the tropics.

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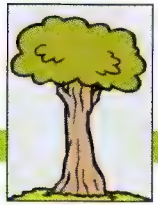
What is the California state flower?



PLANTS AND TREES

1. Daisy
2. Sunflower
3. Poppy

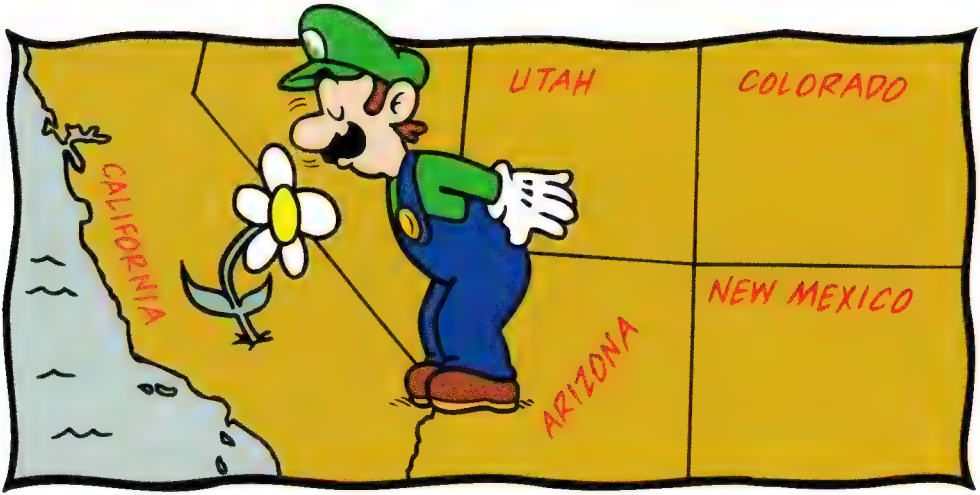


Illustration Gary Fields

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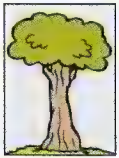
California Poppy

There are many members of the poppy family all over the world. Poppy flowers come in many different sizes and colors.

3 The official state flower of California is the poppy.



© Len Sirman

These red poppies are eye-catching in the middle of a cultivated field.

Certain types of red poppies have followed man's migrations all around the world. These flowers enjoy nothing better than a good piece of plowed land in which to grow. They grow especially well alongside grain producing plants such as oats, barley, and wheat. Once established, they spread their roots and secrete a substance that keeps other plants from germinating nearby.

A State Flower

In North America there are about 20 native species. The most famous one is the California poppy whose bright orange blooms enliven the roadsides in the early summer. Because it is the state flower, it is illegal for anybody to pick California poppies that grow on public property. Poppies have four to six delicate petals surrounding the center ovary. These dark centers eventually produce seeds. Depending on the variety of poppy, the seeds may be used to make medicine, or as flavoring in breads and cakes.

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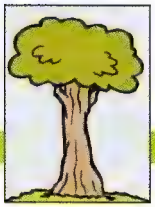
What is a French Garden?



PLANTS AND TREES

1. A vegetable garden
2. A fancy ornamental garden made of small well-trimmed, sculpted hedges
3. A garden of tropical trees

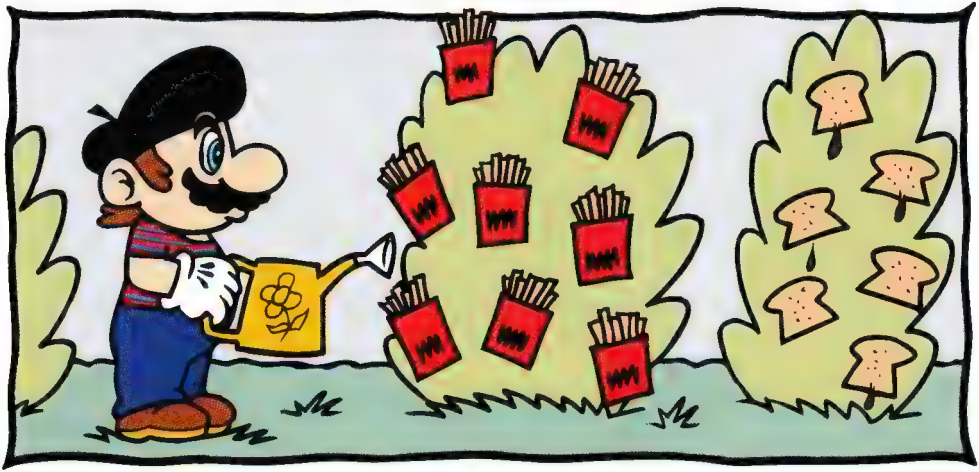


Illustration Gary Fields

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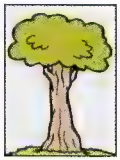
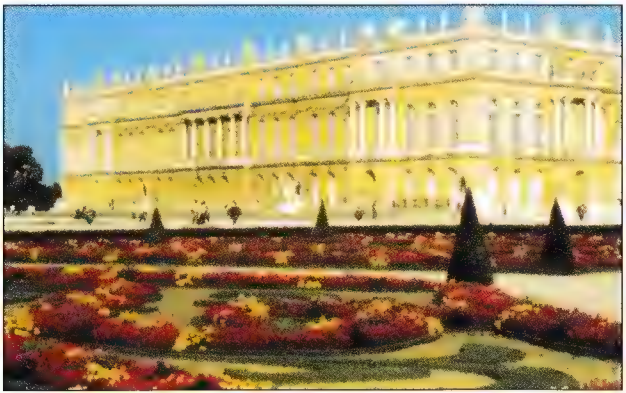
French Gardens

At the beginning of the 17th century, French gardeners, influenced by Italy, began creating incredibly ornate outdoor gardens for the king's palaces.

2 French gardens are fancy ornamental gardens containing small well-trimmed, sculpted hedges.





© Len Sirman

Multi-colored and shaped plants sometimes give a French garden the look of a painted picture.

French gardens originated back in the days when art, beauty, elegance, and grandeur were among the most important things in the lives of royalty and their following. French gardens can still be found surrounding many palaces and mansions around the world today.

Sculpted Hedges

The gardens are formed primarily by boxwood hedges which are cultivated in long rows, circles and other geometric shapes. The hedges are then pruned and sculpted into elaborate designs. Different plants, shrubs and flowers are interwoven to add different textures with small seasonal bunches of flowers sprinkled around to add color. Colored sand, pebbles, and bricks are included in the design to deter weeds and make it easier to maintain the gardens.

The French palace at Versailles boasts the most beautiful and ornate French gardens in Europe.

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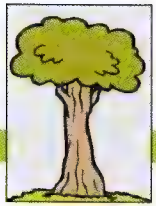
How can you tell the age of a tree?



PLANTS AND TREES

1. By how many branches it has
2. By how many rings the trunk has
3. By how many leaves it has

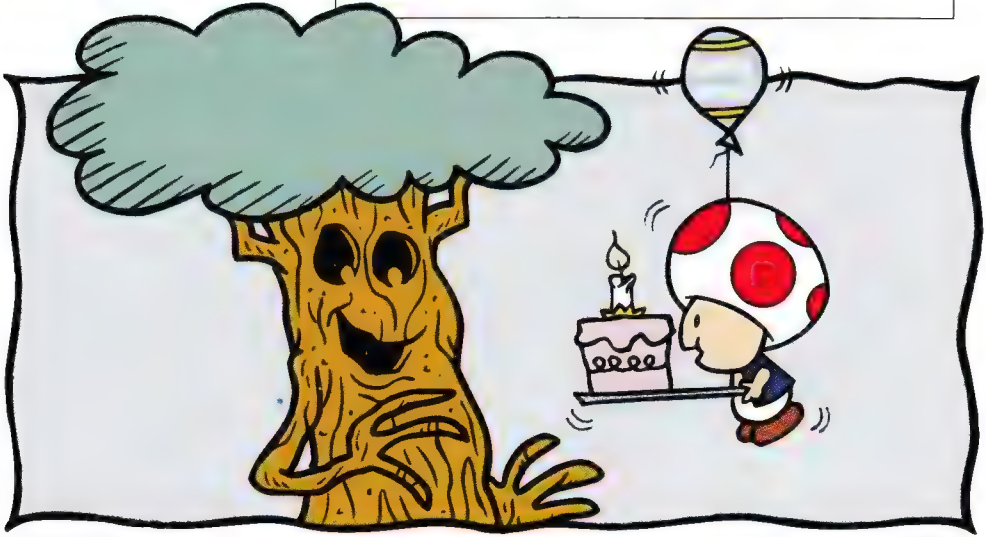


Illustration: Gary Fields

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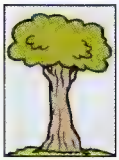
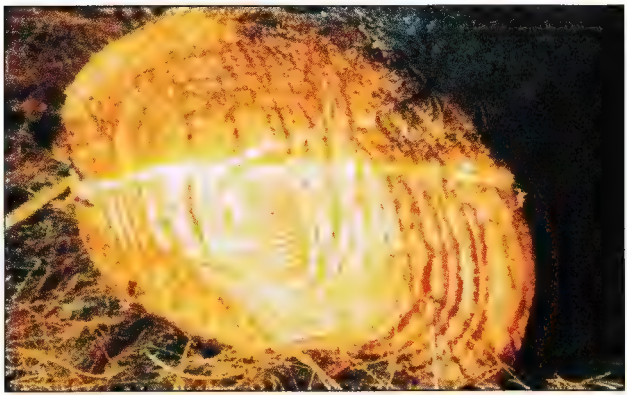
Tree Parts

The three main parts of a tree are the roots, the trunk and branches, and the leaves.

2 **You can tell the age of a tree by cross cutting the trunk and counting how many rings there are.**





© Len Sirman

Ring reading tells us a lot about a tree.

As a tree grows its trunk grows wider and its branches and twigs grow longer. Each year, the layer of plant tissue located between the tree's inner bark and its wood—the cambium—adds a layer of cells—a ring—to the previous year's growth of wood. By counting the number of rings you can tell how old a tree is.

Ring Language

Not only will the rings tell you how old a tree is, each ring also can tell you how the weather was that year, whether there was a fire, a drought, frost, or disease. When there has been plenty of rain a tree will form a nice thick ring. When a tree has suffered from a fire, drought, frost, or disease, there may be only a partial ring or in some cases none at all. You can usually tell the difference between a true ring, which has a clear sharp edge, and a false ring, which has a blurry border.

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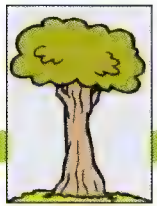
The eucalyptus is native to which continent?



PLANTS AND TREES

1. Asia
2. South America
3. Australia

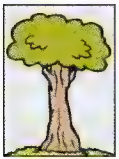
Illustration: Gary Fields

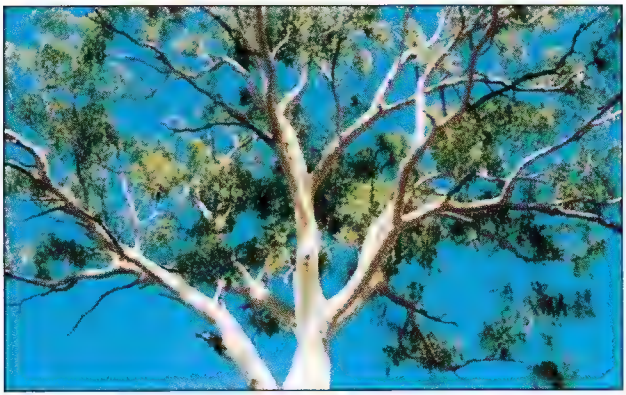
©1995 Nintendo

The Eucalyptus

There are over 500 types of eucalyptus trees in Australia. They are the most common trees in the Australian forests.

3 The eucalyptus tree is originally from Australia.





© Len Stiman

Eucalyptus trees are sensitive to the cold and prefer warm climates.

The name eucalyptus comes from the Greek word which means "well-covered." Botanists believe that this is because most eucalyptus trees have tight fitting caps that cover the flowers until it is time for them to bloom.

Gum Trees

The main way to distinguish between the 500 types of Australian eucalyptus trees is by their different barks. Trees with smooth barks are called "gums." Most species of eucalyptus have long, narrow, leathery leaves. The colors of the flowers in different species range from white to yellow to shades of pink and red.

The eucalyptus is a popular plant in warm regions around the world because it grows fast, has pretty flowers, smells good, and produces a tough durable wood. Some species of eucalyptus have leaves which produce a medicinal oil used in cough syrups and nasal sprays.

The giant gum Eucalyptus is the third tallest tree in the world. The giant gum can grow as tall as 300 feet (90 m).

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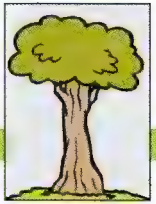
What is lichen?



PLANTS AND TREES

1. A plant which is a combination of algae and fungi
2. An exact replica of something
3. A Swedish cheese

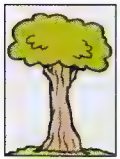
Illustration: Gary Fields

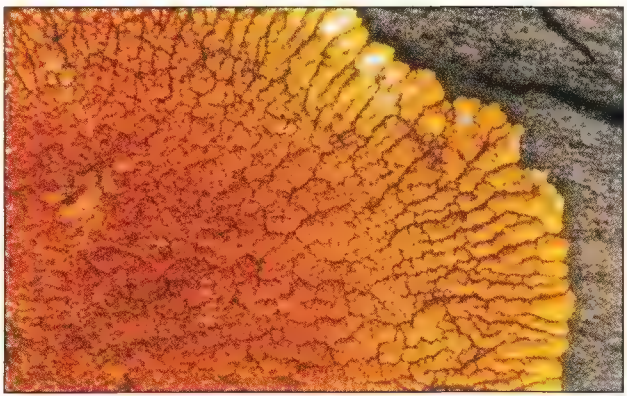
©1995 Nintendo

Symbiosis

Symbiosis occurs when two different species join forces to benefit both of them. When certain types of algae and fungi undergo symbiosis they form lichen.

1 Lichen is a plant which is a combination of algae and fungi.





© Len Sirman

This is a good example of the thread-like networks of the fungi which are happily inhabited by the algae.

Lichen is not really a separate plant, it just appears to be because the fungi and algae are living so closely together. Lichen can be found on tree trunks, rocks, and the ground.

The Happy Couple

Lichen is mostly made of the fungi's interwoven threads. In between these fungi threads algae thrives.

The fungi is hardly ever found living by itself in nature, but algae can live on its own. Scientists think that fungi can't make food for itself so it feeds on algae. Algae provides sustenance for the fungi while the sponge-like structure of fungi keeps the algae from drying out.

There are about 15,000 different types of lichen around the world. They grow particularly well where other plants do not, such as high mountains and deserts.

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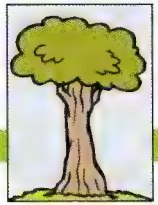
What is the function of tree bark?



PLANTS AND TREES

1. To feed the tree
2. To protect the tree
3. To keep the tree dry

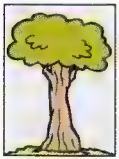
Illustration Gary Fields

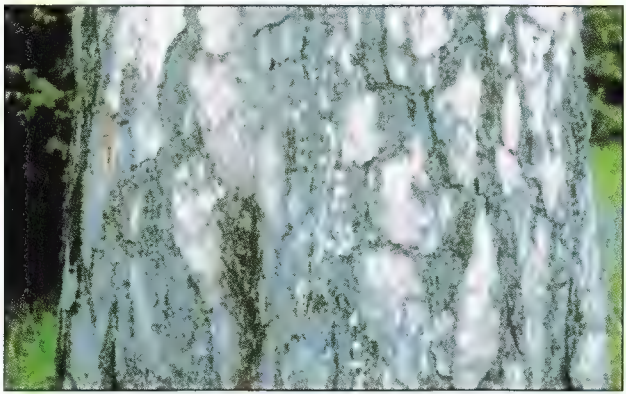
©1995 Nintendo

Tree Bark

Bark protects the inner tissues of a tree from being damaged or exposed to diseases.

2 The function of tree bark is to protect the tree.





© Len Sirman

Bark shields the tree from harmful outside influences.

Right below the layer of bark that surrounds a tree is a layer called the "bast." The bast is a ring of vascular tissue that sends dissolved food substances to the rest of the tree. Below the bast is the cambium. The cambium is responsible for producing new cells that create new wood on its inner surface and new bast on its outer surface. Both the bast and the cambium carry out vital functions for the tree. The bark protects the bast and cambium layers, thereby ensuring the healthy growth of the tree.

Protection

Bark is waterproof so the tissues below it cannot dry out. Bark also keeps most insects and animals from gnawing their way through to the more delicate parts of the tree. Tree bark is also a good insulator and protects the tree from extreme hot or cold temperatures.

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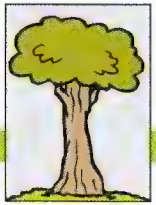
What is the color of raw coffee?



PLANTS AND TREES

1 Red

2 Green

3 White

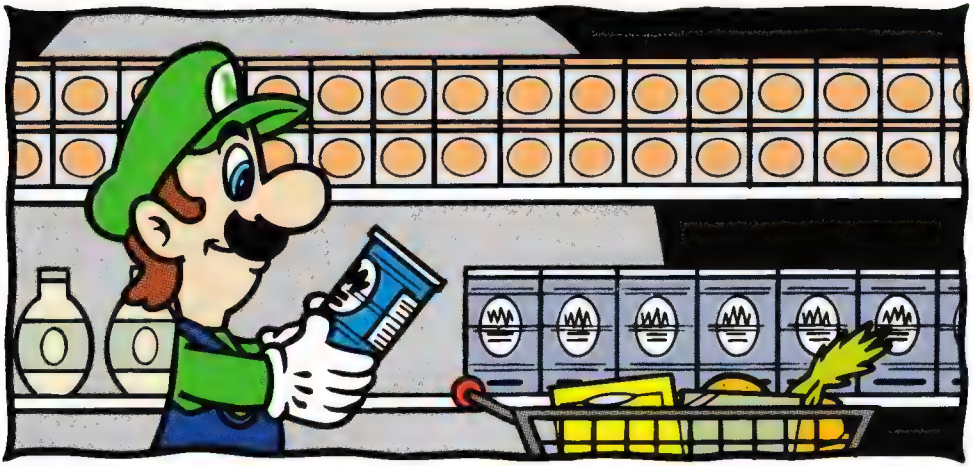


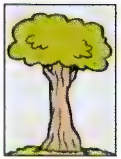
Illustration Gary Fields

©1995 Nintendo

Coffee

The black coffee grounds from which we make coffee come from the green beans found inside clusters of cherry-like fruits which grow on bushes.

2 Freshly picked coffee beans are green.



© Len Sirman

220 pounds (99 kg) of coffee cherries may yield a little over 36 pounds (16 kg) of roasted ground coffee.

The biggest coffee plantations are found in South American countries such as Colombia and Brazil, hot African countries, Asia, and Hawaii. Coffee bushes are fragile plants and must be cultivated with great care. They can be easily destroyed by cold weather or insects.

Harvest Time

The cherries are harvested by hand and dried. The green coffee —two in each cherry—are then removed, roasted and ground. Once the coffee beans are ground, the resulting fine or coarse dark brown or black coffee powder can be mixed with hot water in several ways depending on how strong the drinker likes the taste of his or her coffee. Coffee is drunk by at least a third of the people on Earth making it one of the world's most popular beverages.

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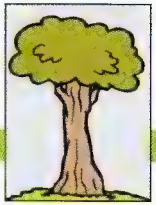
What plant is the word "paper" derived from?



PLANTS AND TREES

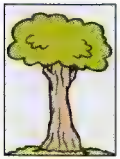
1. Paprika
2. Papyrus
3. Pepper

Illustration: Gary Fields ©1998 Nintendo

Papyrus

Papyrus is a type of reed that, long ago, was found in abundance along the shores of the Nile River and in the Delta region of Egypt.

2 The word "paper" comes from the plant named papyrus.



© Gudeau Aunos / Hoa Qui

Modern Egyptians still make papyrus on which artists draw traditional pictures.

Ancient Egyptians used the entire papyrus plant, from the roots to the tip. The root was used for fuel, the part of the reed submerged in water contains sugar and starch, and torch wicks were made out of the spongy top of the plant. The stalks were also used to make rope, matting, canvases, and even small boats.

Rolls of Papyrus

The stalk stripped of its bark was finely sliced, stacked in layers then hammered and flattened to a thin sheet. Once shaped this sheet was dried under a weight before being glued to other sheets in order to make a two-sided roll of "paper." Some of the world's earliest "books" were written on scrolls of papyrus.

Today paper is made from wood pulp obtained from trees.

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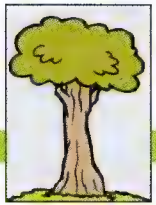
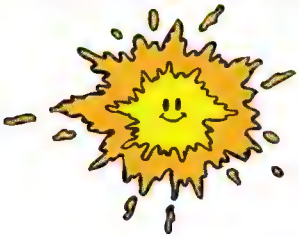
What is a liana?



PLANTS AND TREES



1. A vine
2. A gardening tool
3. A type of lizard

Illustration: Gary Fields

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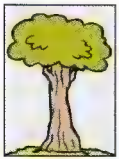
Liana

Lianas are plants whose branches are not strong enough to hold themselves up so they climb things, like trees.

1 Liana is a climbing vine found in rain forests.



© Len Sirman

Trying their best to break through the forest canopy to reach the sun, lianas climb all over this big oak tree.

Lianas can grow thick—and tall—up to 2 feet (60 cm) thick and 330 feet (99 m) tall. Two types of lianas, called leaners and scramblers, are unable to support themselves as they grow so they lean on trees while they make their way up toward the sun. These lianas look like they could be the kind Tarzan used to swing on but in fact, they're not strong enough to hold much more than a monkey.

Climbing, Twisting Vines

Other types of lianas wrap themselves around branches and tree trunks, winding their way up to the forest canopy. Some tropical rain forest vines have tendrils which attach themselves to any and every kind of surrounding vegetation. Liana vines include species such ivy, grapevines, a variety of honeysuckle, and vanilla vine. The brightly colored flowering plant called Bougainvillea is also a liana. It climbs high into forest trees by means of thorns or prickles.

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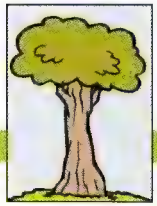
What is topiary?



PLANTS AND TREES

1. The art of training and sculpting plants
2. Bee keeping
3. Setting jewels

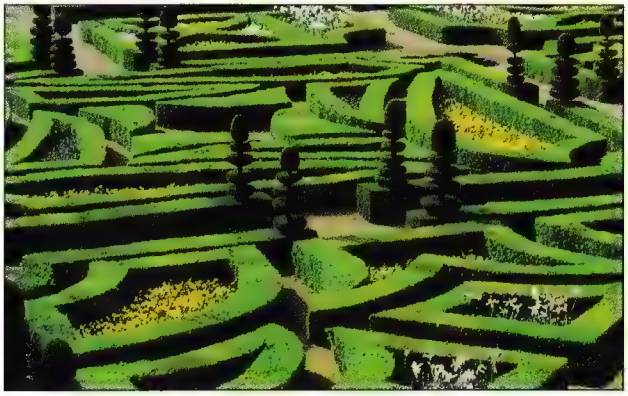
Illustration: Gary Fields

©1995 Nintendo

Topiary

Topiary is the art of training trees, shrubs, and hedges to grow into decorative shapes. It is a kind of sculpture using plants.

1 **Topiary is the art of training and sculpting certain plants.**



© Len Sirman

Topiary art is still practiced in certain palace and chateau gardens in France.

Topiary has probably been around as long as people have taken the time to prune the plants around them! Some claim that the art was invented in the first century A.D. by a friend of Roman Emperor Augustus.

Art in the Garden

Topiary was most popular in places like England and Holland, where plants were abundant but there was a shortage of marble and other stone sculpting materials. The plants most frequently used in this art were rosemary, boxwood, cypress, holly, honeysuckle, and yew. In the 18th century, topiary was known as the "tree barber's art." The earliest was probably the simple square shaping of hedges. Later, hedges were shaped into cones, columns, and spires to dress up gardens even more. The most elaborate topiary included figures such as ships, people, and animals. Topiary reached its peak in the early 18th century but is still practiced and enjoyed today.

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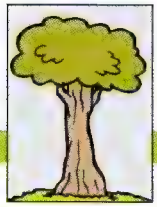
What is alfalfa?



PLANTS AND TREES

1. A type of sea anemone
2. A plant fed to livestock
3. A beverage

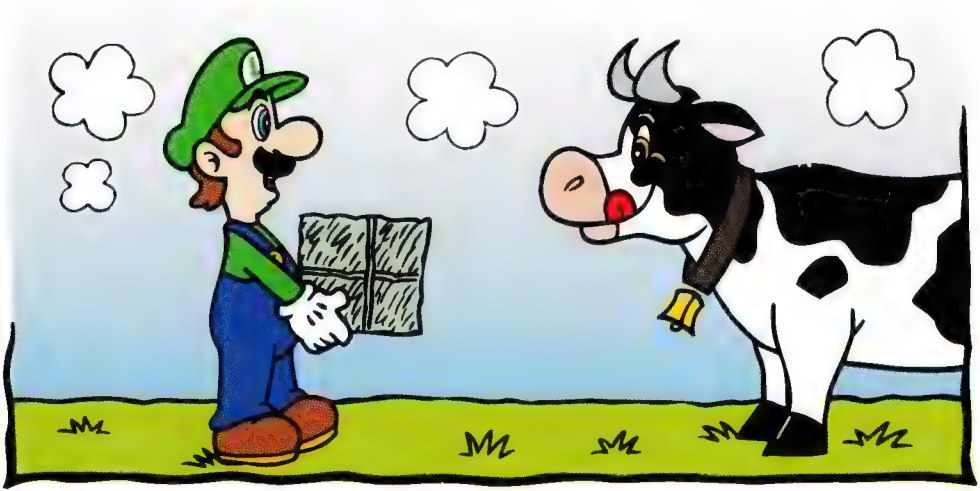


Illustration. Gary Fields

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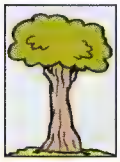
Alfalfa

Alfalfa is the oldest plant used to feed livestock. It was grown as a crop in the Middle East earlier than 1000 B.C.

2 Alfalfa is a plant fed to livestock.



© Moulu / Sunset

Before being cultivated, alfalfa grew in wild meadows like grass.

Alfalfa—also called lucerne and purple medic—is a legume, or member of the pea family, like clover. Alfalfa grows to a height of between 1 and 3 feet (30 to 90 cm). When in bloom, alfalfa sports thick, short tufts of purple flowers.

Alfalfa is native to Europe but is now grown all over the Western Hemisphere and Australia. The U.S. is the largest producer of alfalfa as a feed crop.

While primarily harvested as hay or food for livestock today, alfalfa is still occasionally used for cattle grazing.

Harvest Time

Alfalfa for hay is first cut and left to dry in the fields. Then it is harvested, baled, and stored in lofts for later use. Fresh alfalfa can be made into silage, or food, for pigs, sheep, and cows. It is more nutritious than dried alfalfa, but it cannot be stored for a long time.

Dry alfalfa can also be ground into meal and fed to chickens, ducks, and geese.

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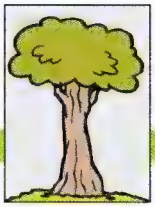
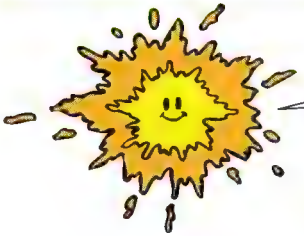
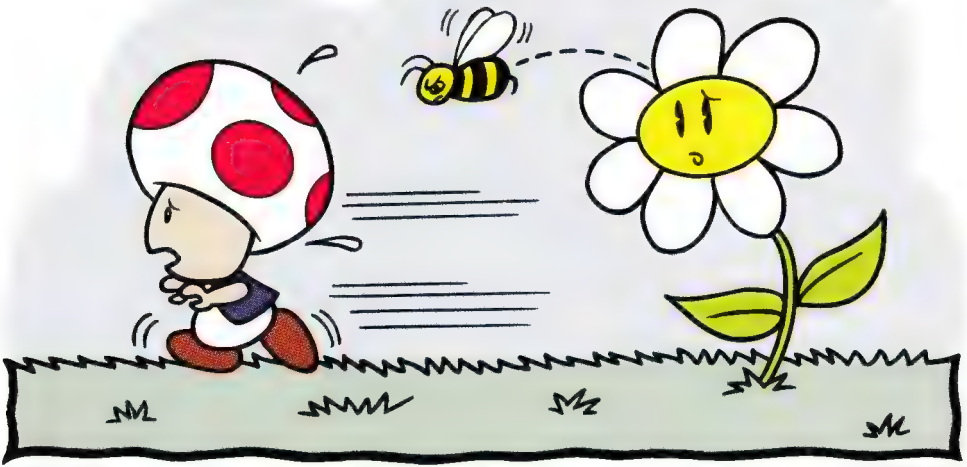
What is the flower of romance?



PLANTS AND TREES



1. Dandelion
2. Rose
3. Tulip



Illustration, Gary Fields

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Flowers

Flowers are often given as gifts and used for decoration. People believe that certain flowers symbolize particular ideas or feelings.

2 The flower of love is the rose.

© Len Sirman

In the United States, it's traditional to give a bouquet of flowers to mothers and grandmothers on Mother's Day.

Red roses symbolize romance. White lilies symbolize purity, which is why many brides carry them in bouquets.

A Flower a Month

Did you know that there is a special flower that corresponds to the month of your birth? If you were born in January, your flower is the carnation. If you were a February baby, it's the violet. March's flower is the jonquil, a flower a lot like a daffodil. April's is the daisy, and May's is the lily of the valley, a tiny, sweet-smelling blossom often used in perfumes. June's is the rose, July's flower is the larkspur, and August's is the poppy. September's is the aster, a flower that blooms in fall. October is represented by the cosmos, a colorful, showy flower. November's flower is the chrysanthemum, called "mum" for short, and December's is the narcissus.

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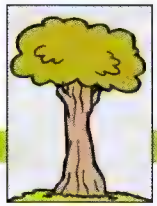
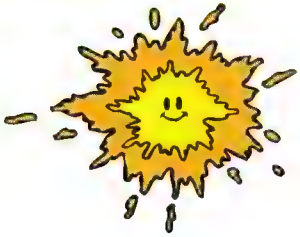
Which tree can be found in the savanna?



PLANTS AND TREES



1. Baobab
2. Elm
3. Palm

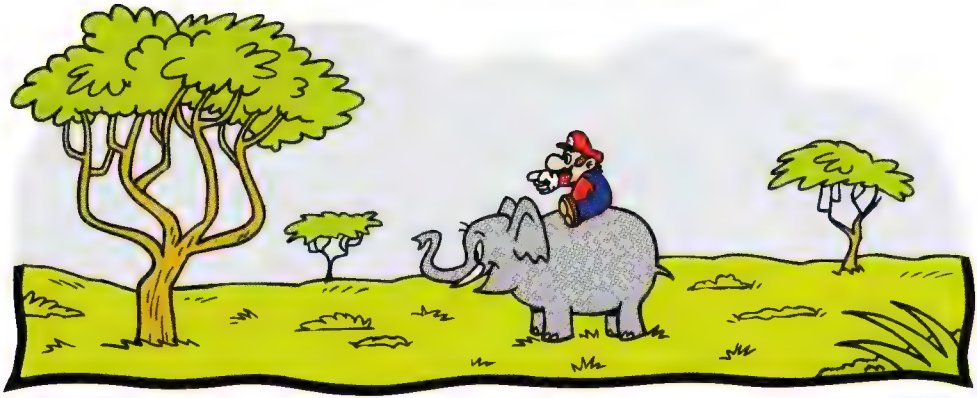


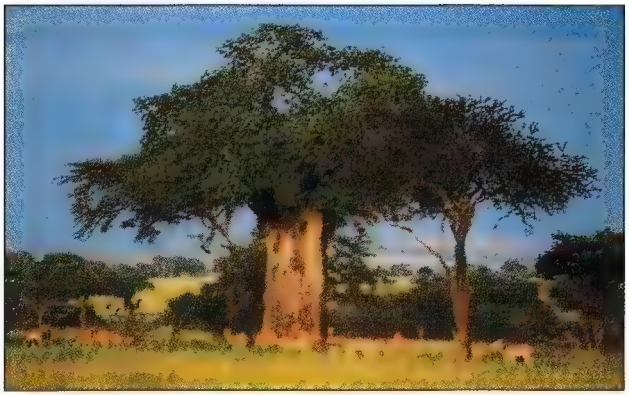
Illustration: Gary Fields

©1995 Nintendo

Baobab

The baobab tree, native to the African savanna, is particularly well-suited to surviving in areas where there is a very long dry season.

1 The baobab tree can be found in the savanna.



© M. Renaudeau / Hoa Qui

The baobab has a very wide trunk. It is well equipped to survive the dry season.

The baobab tree has a very wide bottle- or barrel-shaped trunk, which can grow up to 30 feet (9 m) in diameter and very thick branches. The inside of the trunk and lower branches is soft and spongy, and can store large quantities of water. During the dry season, the baobab remains leafless. This reduces the transpiration, or water loss, that occurs through the surface of leaves.

Slow Growth

The baobab grows slowly, but over thousands of years, it can become huge, its foliage—leaves and branches—often spreading as far as 150 feet (45.5 m) across. The fruit of the baobab is called monkey bread and is used to prepare tasty refreshing drinks. Fiber from the tree's bark is used to make rope and cloth.

An Arabic legend says that the devil pulled the baobab tree out of the ground and threw it back, head first into the ground, leaving its roots exposed to the air.

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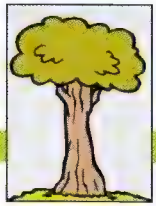
What is a deciduous tree?



PLANTS AND TREES

1. A poisonous tree
2. A tropical tree
3. A tree that loses its leaves in the fall

Illustration: Gary Fields

©1995 Nintendo

Deciduous Trees

Deciduous trees, which lose their leaves in the fall, are the dominant species in the temperate forests of the eastern United States and Europe.

3 A deciduous tree is a tree that loses its leaves in the fall.

© Len Sirman

Deciduous trees drop their leaves in the fall.

Deciduous trees are angiosperms: Their seeds are enclosed in a fruit, like an acorn or a beechnut. Inside this hard shell, the bud remains protected. Deciduous trees have many branches covered in large, flat leaves to capture as much sunlight as possible. But these same leaves become more of a burden than a help when cold weather sets in. In winter, there is not much sunshine for them to catch, the tree draws less water from the soil and can't provide enough nutrients to sustain the leaves.

Abscission

So deciduous trees drop their leaves. This is called abscission—meaning cutting off, or removal. A plant hormone called abscisic acid causes a layer of abscission cells to form at the base of each leaf stem. These cells weaken the base of the stem until the leaf is broken off by the wind. Then another layer of cells forms to seal off the wound.

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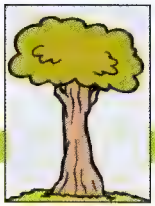
Where does cork come from?



PLANTS AND TREES

1. Oak trees
2. Sea plants
3. Mineral deposits

Illustration: Gary Fields

©1995 Nintendo

Cork

More than 300 varieties of oak grow in the temperate regions of the world. One of these varieties is the cork oak, native to the Mediterranean region.

1 Cork comes from oak trees.

© Marge / Sunset

Cork oaks usually grow about 30 feet (9 m) high. After the bark is removed, they regenerate a new layer of cork 1 to 2 inches (25–50 cm) thick within eight to eleven years.

Cork is the thick, outer bark of the cork oak. It is composed of dead cells. Cork oak trees are first stripped of their bark when they are 15 to 20 years old. The bark is cut off carefully so as not to damage the living inner bark. The bark from this first harvest tends to be quite coarse, with relatively large holes and recesses. But with each harvest, every eight to eleven years, the quality of the cork improves, becoming more dense and smooth.

Uses of Cork

Cork is a plant tissue made up of dead plant cells. Suberin, a waxy substance located in the cell walls, makes cork waterproof, buoyant, resilient and a good insulator. These properties make it an effective material for many products: bottle stoppers, shoe insoles, floats, floor coverings and bulletin boards. It is even used for the core of baseballs.

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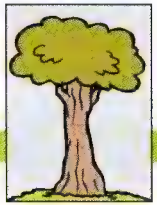
What is guano?



PLANTS AND TREES

1. Sea bird excrement used as fertilizer
2. A paste made from shredded newspaper
3. A saltwater fish

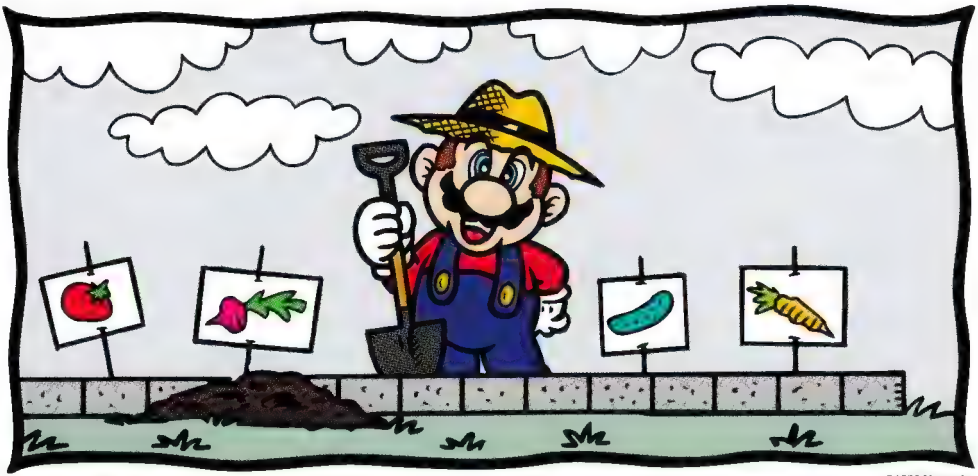


Illustration: Gary Fields

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Guano

Guano, which means dung in Spanish, is the dried excrement of sea birds. Rich in nitrogen, phosphorus and potassium, it makes an exceptional fertilizer for agricultural crops.

1 Guano is sea bird excrement used as fertilizer.

© R. Scitre / Sipa Press

In Peru, Guano is collected every two years. The government distributes it to farmers based on how much land they cultivate.

Guano has been used as a fertilizer in Peru since before the Spanish conquest. In the 1800s, Peruvians began exporting it in great quantities. The cold salt water fostered the development of plankton on which anchovies fed. In turn, the anchovies attracted hoards of sea birds who feasted on this ample source of food. The piles of guano produced by the birds often measured more than 100 feet (30 m) high. For the past 50 years or so, a warmer, less salty sea current has been flowing into the area. The plankton cannot live in the warmer water. As a result, the anchovies and most of the birds have disappeared.

Important sources of sea bird guano are also found in Mexico, Chile and Ecuador, and the guano of bats is mined from caves such as the Grand Canyon Bat Cave in Arizona. Fish guano refers to the organic fertilizer produced from dried and powdered fish.

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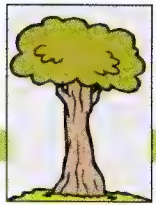
What is a larch?



PLANTS AND TREES

1. An Australian waterlily
2. A type of pine tree
3. A common edible mushroom

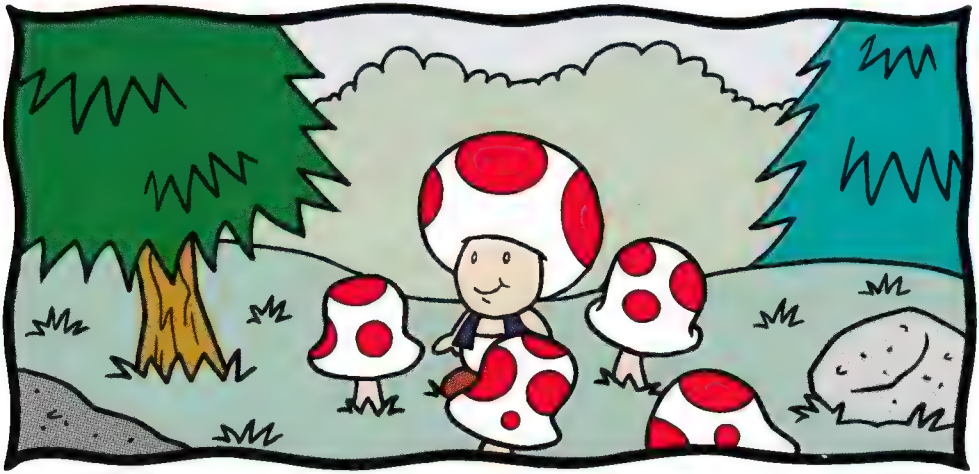


Illustration: Gary Fields

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Larches

Larches grow in the Alps at altitudes up to 8,250 feet (2,500 m). They like cool climates with lots of moisture and direct sunlight.

2 Larches are deciduous trees in the pine family.

© Len Sirman

The larch, a relative of the cedar, is a common tree in the Alps.

Larches are members of the pine family, but unlike most pines they drop their soft, needle-like leaves each fall and grow new ones each spring. Trees produce oval-shaped cones bearing about twenty long scales. Larches grow to heights of 40 to 80 feet (12 to 24 m), with an average trunk diameter of about 2 feet (60 cm). They thrive in moist soil.

Ten Known Species

There are ten known larch species in the world. Three are native to North America: the American larch, also known as tamarack or hackmatack, grows from Alaska to Newfoundland in Canada. Western larches grow in the northwestern United States and southeastern Canada. The subalpine larch grows in the same areas as the western larch but at higher elevations. European larches are cultivated in Europe for timber.

Because the larch's hard, sturdy wood is difficult to work with tools, it is often used for telephone poles, signposts, railroad ties, and flooring.

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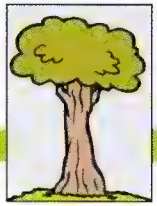
What is the cause of most forest fires?



PLANTS AND TREES

1. Lightning
2. Human carelessness or arson
3. Intense summer heat

Illustration: Gary Fields

©1996 Nintendo

Forest Fires

During periods of hot, dry weather, trees and undergrowth dry out. Just the slightest spark can set them on fire.

2 Most forest fires are caused by human carelessness and arson.

© Len Sirman

During severe fires, airplanes may be used to spray chemicals on the fire to extinguish it.

Forest fires are not always bad. Some are a natural part of the ecosystem, cleaning out and renewing forest growth. But many forest fires occur when people forget to douse their campfires properly, or when they set fire on purpose. Setting fires deliberately to cause destruction is a crime—it's called arson.

Three Types of Forest Fires

Ground fires involve only the humus—dead plant matter—covering the forest floor and generally burn just beneath the surface. Surface fires burn undergrowth and surface material. Crown fires spread through the treetops. It is common for more than one type of fire to occur at the same time.

Fire Extinguishers

Sand or water is used to put out ground fires. Trenches are dug around the fire to contain it. To control surface fires, low vegetation and litter in surrounding areas is cleaned out to prevent the fire from spreading. Crown fires, the hardest to extinguish, may be left to burn themselves out or may stop upon reaching a stream.

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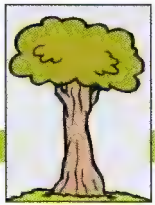
What is acid rain?



PLANTS AND TREES

1. Pollution
2. A musical group
3. Sour candy

Illustration Gary Fields

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Acid Rain

Acid rain is harmful acid atmospheric precipitation resulting from the mixture of manmade chemical substances and moisture in the air.

1 Acid rain is a form of pollution.

© Len Sirman

Acid rain inhibits the nitrogen fixation necessary for the growth of healthy trees.

Gases such as sulfur dioxide and nitrogen oxide are emitted from cars, electrical power plants, and from the burning of fossil fuels such as coal and petroleum. When these gases combine with the moisture in our atmosphere, they form sulfuric and nitric acids. These acids can be carried by winds for hundreds of miles before falling on the earth in the form of rain, snow, or fog.

Damaging Precipitation

Acid rain is particularly harmful to lakes, rivers, and streams. For aquatic life to flourish, water must maintain a low level of acidity. Acid rain causes the acid level to rise which is detrimental to fish and aquatic plant life. Agricultural crops, forests, and other types of vegetation can also be damaged by acid rain.

United States, Canada, and the more industrialized parts of Europe are most responsible for the formation of acid rain. Throughout the world, industries are beginning to take steps to reduce thier harmful emissions.

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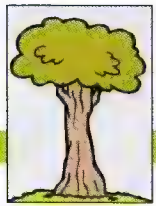
What is agricultural ecology?



PLANTS AND TREES

1. A way to recycle tractors
2. Another name for fish-farming
3. The study of healthy ways to grow crops

Illustration Gary Fields

©1996 Nintendo

Agricultural Ecology

Using agricultural ecology, farmers study interactions among living organisms, and how they benefit each other.

3 Agricultural ecology is the study of healthy ways to grow crops.

© E. Valentin / Hoaqui

Part of agricultural ecology is seeking efficient ways to water crops. One of the most efficient is drip irrigation, shown here.

To fertilize crops and keep them free of weeds, disease and insect pests, modern day farmers often use chemical fertilizers, pesticides and herbicides. But these chemicals can be harmful to human beings and animals, and their residue can poison the soil and water. That's why many farmers now seek ecologically sound ways to grow crops.

Working with Nature

One way to grow healthy crops without chemicals is to plant crops together based on how they can help each other. All plants take nutrients, such as nitrogen, out of the soil to help them grow, but each plant takes different nutrients. In addition, plants often put back nutrients into the soil. The trick is to plant crops that balance each other so that if one plant draws nitrogen from the soil, the other plant replenishes it. The plants work together to keep each other healthy.

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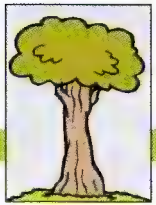
What is humus?



PLANTS AND TREES

1. A medical condition
2. An organic component of soil
3. A type of seaweed

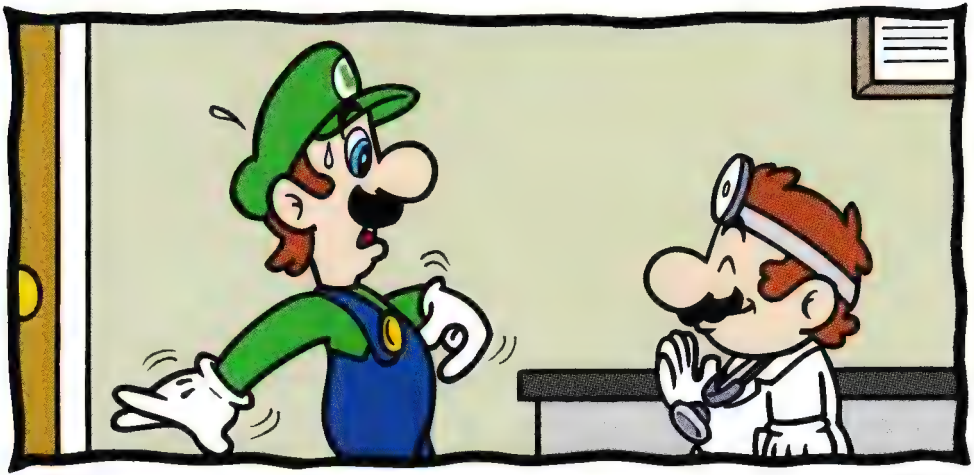


Illustration Gary Fields

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Humus

Humus is made up of decayed animal and vegetable matter. This dirt-like substance supplies many of the nutrients necessary for plants to grow.

2 Humus is the organic part of soil.

© Kid / Kervella / Hosqu

Humus is the nutrient-rich part of the soil that helps plants grow.

Humus is made up of approximately 60 percent carbon, 6 percent nitrogen, and small amounts of sulfur and phosphorous. As the animal and vegetable parts of humus decompose, it provides plant life with nutrients. Humus also makes it possible for soil to absorb water more efficiently and it helps to aerate soils thereby improving cultivation.

Humus Types

Mor-humus formation is found in coniferous forest regions where there are few micro-organisms, such as earthworms, to help decompose the soil surface. Mull-humus is found in warmer regions where the warmer and more humid climate allows the humus to decompose quickly. It mixes well with other soils. In these regions there are plenty of earthworms as well as insects and bacteria.

The third type of humus, moder-humus, is composed mostly of insects. Although rich in organic matter, moder-humus doesn't mix as well with other soils.

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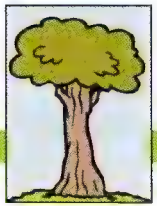
What do tulips and onions have in common?



PLANTS AND TREES

1. They are both aquatic plants
2. They both grow from bulbs
3. They are both carnivorous plants

Illustration: Gary Fields

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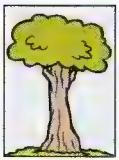
Bulbs

Tulips are the best-known of the flowering bulbs. In the Netherlands, tulip breeding is a major industry.

2 The tulip and the onion both grow from bulbs.



© Len Sirman

Some bulbs are used as food, such as onions (photo), garlic, chives and shallots.

A bulb is a type of plant that grows underground, but gives off a bud that flowers above ground. There are two main types of bulbs. The onion and other bulbs like it, such as the shallot, garlic, and leek, have a thin papery covering protecting fleshy leaves. Flowering bulbs, such as the hyacinth, tulip, narcissus, and lily, are unprotected by any covering and appear to be made up of a series of scales.

Hardy Bulbs

Bulbs flower once a year, some types in the spring and some in summer. They can survive during the colder or drier months because of food stores in their fleshy leaves. This enables them to grow in climates where other flowering plants cannot. For instance, the center of tulip breeding is the Netherlands, where winter is long. And the onion is known for its ability to survive frosts. Not all bulbs are decorative or tasty. One type, called the red squill, is used to make rat poison.

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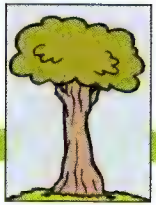
Where can you find mushrooms that are safe to eat?



PLANTS AND TREES

1. In the woods
2. In the grocery store
3. In the garden

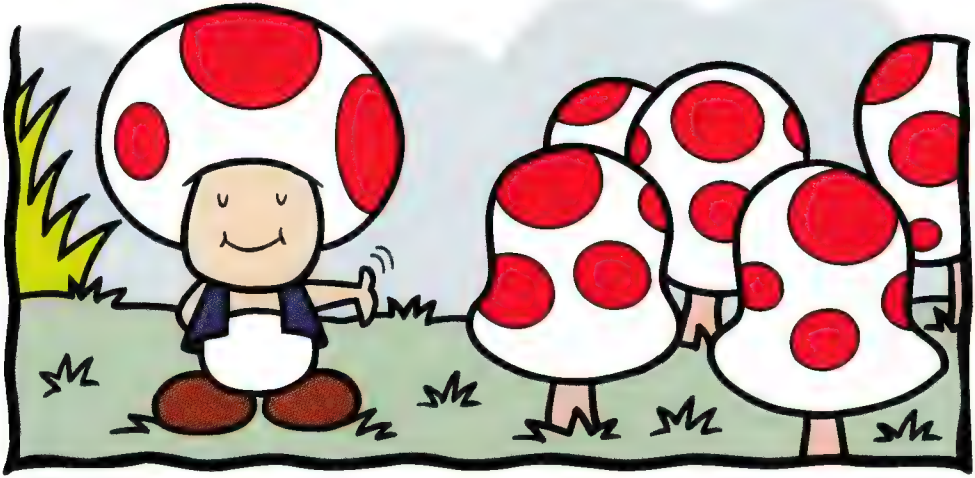


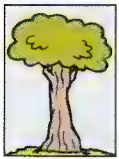
Illustration Gary Fields

©1995 Nintendo

Mushrooms

Mushrooms are the sporophores, or fruiting bodies, of certain types of fungi. Some are highly prized in cooking—but others are deadly.

2 **The only way you can be sure that mushrooms are safe is by buying them in the grocery store.**



© NHPA / Sunset

Mushroom stems and caps are just the visible parts of the sporophores.

Mushrooms are the only edible fungus, but not all types of mushrooms are safe to eat. Only experts can tell you without a doubt what is and is not safe to eat. Therefore, you should never eat any mushroom that you find growing in the wild.

Mushroom Structure

Mushrooms are made up of a cap and stalk with an extensive underground network of threadlike strands called a mycelium. The mycelium can live hundreds of years or die within a few months, depending on the available food supply. As long as the soil or the tree it is growing in provides nourishment and the temperature and moisture are suitable, a mycelium will produce a new crop of sporophores—the part we recognize as mushrooms—every year.

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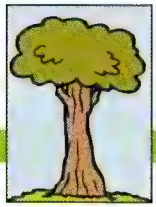
What color are butterflies attracted to?



PLANTS AND TREES

1. Yellow
2. Blue
3. Red

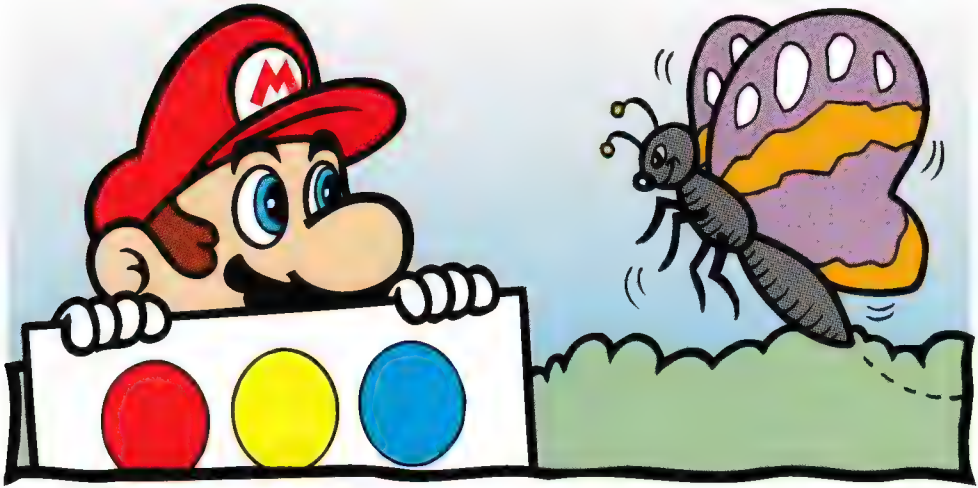


Illustration. Gary Fields

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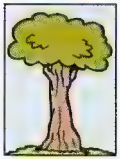
Flower Colors

One of the brightest colors to the human eye, red is not perceived by most insects. But red flowers and fruits attract birds.

3 **Butterflies are attracted to the color red.**



© Len Sirman

Butterflies and birds are attracted to red flowers and berries.

Red poppies would probably leave bees indifferent if, unlike humans, they weren't so sensitive to the ultra violet rays emitted by the sun and reflected by the corolla, or the part of the flower that is formed by the petals. Bees perceive, or see red as a dark shade of gray; green as a light yellow, and white as a blue-green.

In nature, where the color green is dominant, the less common colors such as red and blue have a secret, and sometimes very complex, code. This code is read differently by the various species of the animal kingdom.

Color Coded Messages

Birds see colors very well. They are particular attracted to red, purple, and black fruits. For holly and hawthorn plants, it is the best way to have their seeds scattered. The death cap, a red mushroom with white polka dots, attracts spore-carrying flies.

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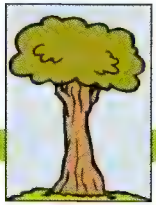
What is balsa?



PLANTS AND TREES

1. A spicy Mexican dip
2. A South American dance
3. A South American tree

Illustration: Gary Fields

©1996 Nintendo

Balsa

Balsa trees can be found in many places, but are native to tropical South America. They are noted for their exceptionally light wood and its many uses.

3 Balsa is a type of South American tree.

© Goudounets / Explorer

Balsa is valued for being strong for its light weight, bouyant, resilient, and easy to cut and shape.

Balsa trees may grow to a height of 60 to 70 feet (18 to 21 m). Their wood, also called corkwood, weighs about only 6 to 8 pounds per cubic foot (96 to 128 kg per cubic meter) and is lighter and stronger than cork. White pine is similar in color to this lightweight wood that has long been used, especially in South America, for raft and boat building. So great is the impact of balsa on shipbuilding that the term "balsa" even refers to a type of raft made of two parallel cylindrical logs connected by a platform.

Other Uses

Balsa wood is also used to make life-preserver floats, surfboards, and model airplanes. It is used in the interiors of aircraft to reduce vibration and as a sound insulator. Balsa is used as a lining material in refrigerators and ship holds because of its heat-insulating qualities.

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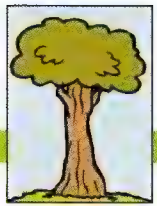
What is silviculture?



PLANTS AND TREES

1. The art of decorating items in silver
2. The cultivation of forest trees
3. The process of extracting silver from another mineral

Illustration: Gary Fields

©1996 Nintendo

Forestry

The science of forestry is dedicated to managing the land so that we can safely use it in many ways. The primary activities of this field are harvesting and replanting timber or trees.

2 Silviculture is the harvesting and replanting of forest trees.

© Gimes M. / Sipa Press

A knowledge of silviculture also requires studying various plants, soils, and climates.

The planned management of forests originated in early medieval Europe. Large tracts of forest land were owned by monarchs and nobles who used the woodland resources for their own needs and traded them for other goods and services. Laws regarding the use and misuse of forests were gradually established by land owners. Today the government defines the amount of timber that can be taken in its legislation and policies. Sometimes it sets aside areas where trees cannot be harvested at all. Forest managers also strictly control the way trees are removed, allowing certain areas to be cleared entirely while others may only be thinned.

Forestry Today

About one-third of the world's land surface is classified as forest land, and roughly 1 percent of the standing timber is harvested each year.

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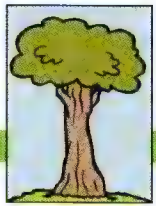
What is resin?



PLANTS AND TREES

1. Food for sheep
2. A small dried fruit
3. A sticky substance secreted by trees

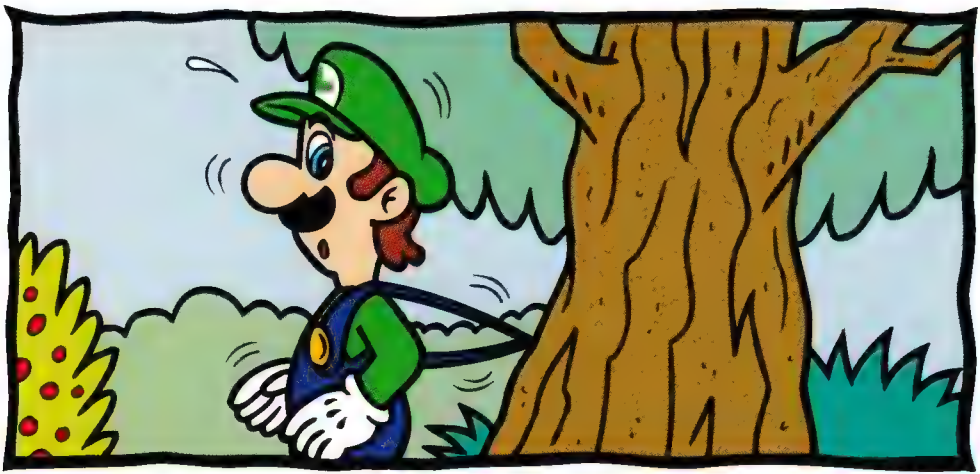


Illustration: Gary Fields

©1996 Nintendo

Resin

Natural resins are sticky liquids that are secreted by many plants. They appear on the surface of a plant after a wound to form a protective coating and help keep the plant healthy.

3 **Certain types of trees produce a gooey substance called resin.**

© Len Sirman

Resins like frankincense and myrrh were highly valued in ancient times as ingredients of perfume, incense, and ointments.

Natural resins are usually yellow to brown in color and are obtained by making cuts in trees and directing the thick liquid through troughs and into collection buckets. Resins are have a variety of uses in products like shellac, turpentine, shoe polish, and sealing wax. They also burn with a smoky flame and produce a heavy aroma.

Hard Resins

There are many different kinds of resin, some even become hard or brittle. Amber is one of many hard, fossilized resins that are often collected from deposits in the ground. Sometimes now-extinct insects are found preserved in pieces of amber.

Perhaps the most important of the hard resins is rosin, which is used in soapmaking, varnishes and paints, and, in powder form, as a coating for stringed instruments like the violin.

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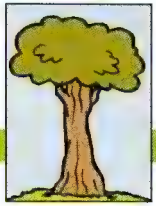
What is crop dusting?



PLANTS AND TREES

1. Cleansing the leaves of plants
2. Spraying crops with pesticides and other substances
3. A way of eliminating excess crops

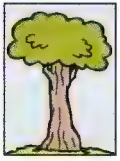
Illustration: Gary Fields

©1996 Nintendo

Crop Dusting

Crop dusting is usually done using an airplane. It is an efficient way to protect crops, but the use of pesticides is a subject of debate.

2 **Crop dusting refers to spraying crops with pesticides and other substances.**



© Hug / Explorer

Crop dusting, though somewhat controversial, is one way in which industry and agriculture work together to protect crops.

Crop dusting, usually done from the air, allows farmers to easily apply pesticides to vast areas of crop. There are two types of pesticides—insecticides, which combat insects such as locusts or herbicides, which combat weeds.

Controversy

Although crop dusting is an efficient way to protect crops, it does have risks. Because the chemical pesticides are released into the air, they may be blown onto land surrounding the farm where they can kill or harm other plants and animals. They also make their way into the groundwater, which we rely on for drinking. Crop dusters try to account for variables like wind speed and direction when they work, but many people believe that crop dusting is too hard to control.

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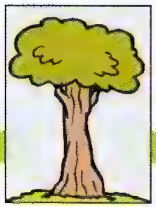
Which vegetable is a tuber?



PLANTS AND TREES

1. Beet
2. Lettuce
3. Potato

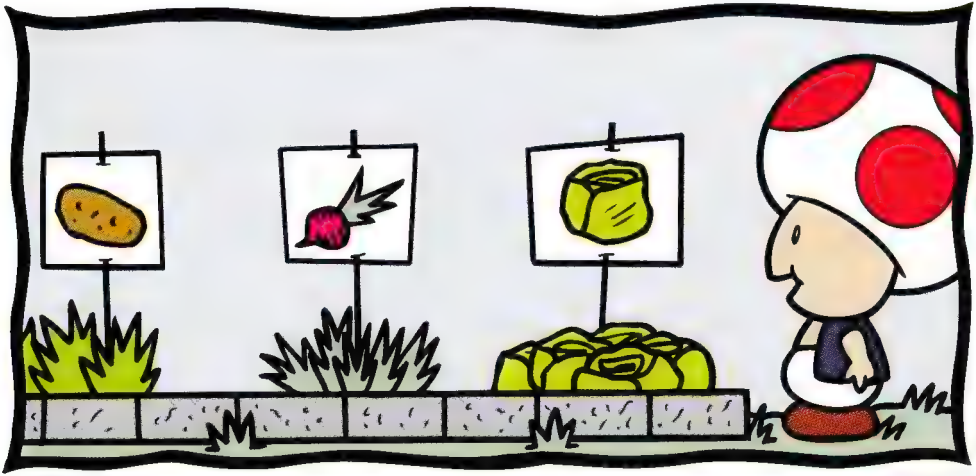


Illustration Gary Fields

©1996 Nintendo

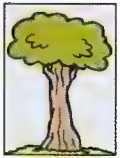
Potatoes

Tubers are the short, thick underground stems of certain seed plants. Tubers store food for the plant as starch.

Potatoes are the world's fourth largest crop, after wheat, rice, and corn. Native to the Andes Mountains in Peru and an important part of the Inca diet, they were introduced to Europe by Spanish explorers in the 16th century.

There are many different kinds of potatoes, with skin ranging from tan to purple and white or light yellow flesh of various textures. Potato plants have coarse, dark-green leaves. They produce flowers that range from white to purple, depending on the variety.

3 The potato is a tuber.



© E. Lennone / Jacana

New potatoes, pictured above, are harvested before they are ripe. They have very thin, tender skin.

While these flowers may turn to berries with seeds inside, new potato plants are usually not grown from seeds. Instead, tiny buds—called eyes—on mature potatoes are used to start new plants. The vegetative, or above ground, part of the potato plant dies each fall or winter.

Versatile Potatoes

Potatoes can be dried, cooked fresh, or stored frozen. Flour, starch, and alcohol extracted from processed potatoes are used to make other foods.

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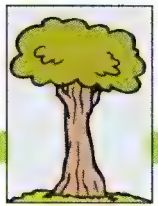
Do cacti flower?



PLANTS AND TREES

1 No, they reproduce by spores.

2 Yes, they produce flowers.

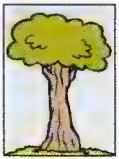
Illustration: Gary Fields

©1996 Nintendo

Cactus

There are about 1,650 different species of cactus. Although cacti are native to most of North and South America, today they can be found all over the world.

2 Yes, cacti are flowering plants.



© Len Stman

Most cacti, like the one above, grow in the ground. A few species are epiphytes, attaching themselves to other plants or hard surfaces like rocks.

Cacti are adapted to life in dry climates. For one thing, they are succulents. This means that they hold a large amount of water in their thick stems and leaves. They also have a shallow network of thin, fibrous roots spread over a wide area to absorb moisture near the surface of the ground.

Size and Shape

Cacti exist in many different shapes and sizes. Button-like peyote and hedgehog cacti grow in clumps close to the ground. Saguaro and barrel cacti grow tall like trees. Some cacti are smooth, while others have bumpy or ridged stems.

Unlike other succulents, cacti have specialized buds called areoles that sprout sharp bristles, spines, flowers, branches, or leaves. Cactus flowers are usually large and colorful but not very abundant. The flowers develop into seed-bearing fruit, usually berries.

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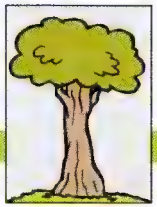
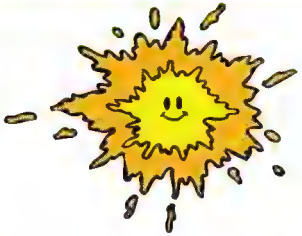
Where did pineapples originate?



PLANTS AND TREES



1. India
2. America
3. Africa

Illustration Gary Fields

©1996 Nintendo

Pineapple

Portuguese explorers brought pineapples to Europe, Africa, and India in the 1500s. Today, fresh and canned pineapple is available in most supermarkets.

2 Pineapples originated in tropical and subtropical America.

© Len Sirman

Pineapples are ripe five or six months after the plant flowers.

The pineapple is a low-growing plant with stiff, pointed leaves that overlap at the base of the stem to form a rosette. Pineapple plants grown from seeds will bear fruit in three or four years. First, the plant produces a single fruit at the top. After it is harvested, smaller fruits grow on lower branches. When these are cut, another crop of even smaller pineapples is produced.

Each pineapple fruit is topped by a small crown of leaves. When planted, these tufts will grow into new pineapple plants that will yield two crops of fruit in three years. Ripe pineapples have a brown, scaly skin and sweet, juicy yellow flesh.

Canned Pineapple

Pineapple for canning is cut in a wide cylinder of flesh from the center of the fruit. After the core is removed, the flesh is sliced or chopped. Then it is pasteurized to remove germs and put into cans with pineapple juice.

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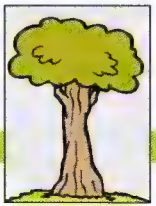
What causes leaves to fall from trees?



PLANTS AND TREES

1. Increased chlorophyll production
2. A weakening in the base of the petiole
3. Excessive sunlight

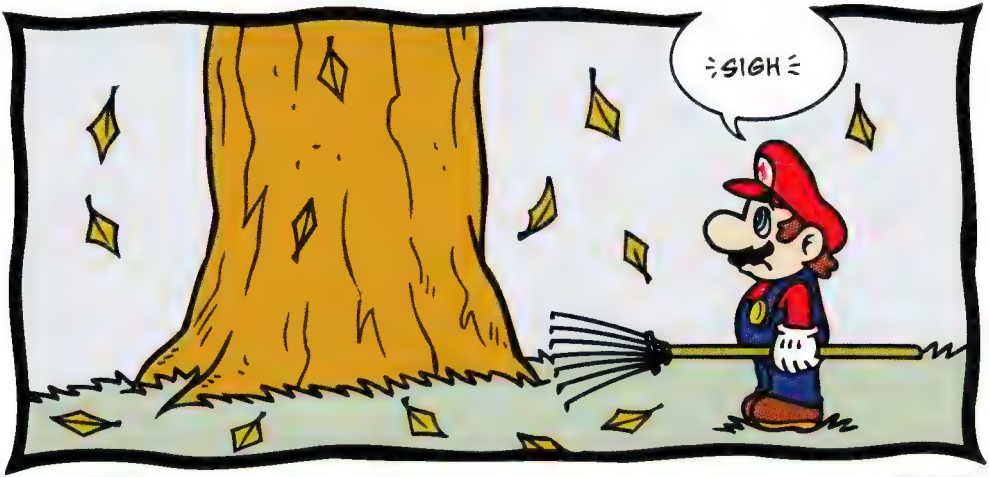


Illustration: Gary Fields

©1996 Nintendo

Petiole

The petiole is the stem that connects the leaf to the branch. When a weak zone called an abscission layer forms at the base of the petiole, the leaf falls from the tree.

2 Trees shed their leaves because of a weakening at the base of the petiole.

© J. P. Varin, Jacana

In spring, buds of new leaves form at the points on branches where old leaves were attached.

Most leaves have a wide, flat blade, called a lamina, attached to the plant by the petiole. Leaves have a network of veins that transport food and water between them and the rest of the plant. When trees shed their leaves in cold weather, the circulation of sap, or fluid carrying food and water, stops. Without leaves, and with no circulation of sap, trees need much less water. Thanks to this adaptation, trees are able to survive during the cold months. Without it, trees would dry of drought, since they cannot draw water from the ground at temperatures below about 40°F (5°C).

Falling Leaves

Leaves normally fall from trees before winter in temperate regions and before the hot season in warm, dry climates. Trees also shed their leaves when they are damaged by drought, insects, or disease.

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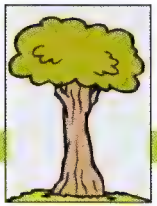
What makes leaves green?



PLANTS AND TREES

1. Chlorophyll
2. Amber
3. Sap

Illustration: Gary Fields

©1996 Nintendo

Chlorophyll

Photosynthesis is the process by which leaves produce food for a plant. The word photosynthesis contains the root "photo," or light, and "synthesis," which means production.

1 Chlorophyll is the substance that makes leaves green.

© Veiller / Jacana

Green plants contain chlorophyll. The word chlorophyll comes from the Greek words for "green" and "leaf."

During photosynthesis, a green pigment called chlorophyll absorbs the energy in sunlight. Plants use this energy to produce sugars and oxygen from water and carbon dioxide, a gas in the air. These sugars are a source of energy for growing plants.

Chlorophyll is in a plant's leaves and sometimes in other parts, such as the stem. When leaves lose chlorophyll, other pigments become visible. That is why leaves turn red, orange, yellow, and brown in the fall.

Source of Life

Earth's atmosphere was formed four and one-half billion years ago from the gases emitted by volcanoes. At first, there was no oxygen, a gas humans and other animals need to survive. About 99 percent of the oxygen added to Earth's atmosphere was released during photosynthesis.

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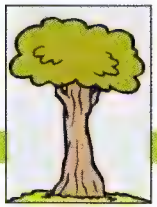
What is the main function of leaves?



PLANTS AND TREES

1. To protect the plant
2. To produce food for the plant
3. To shade lower portions of the plant

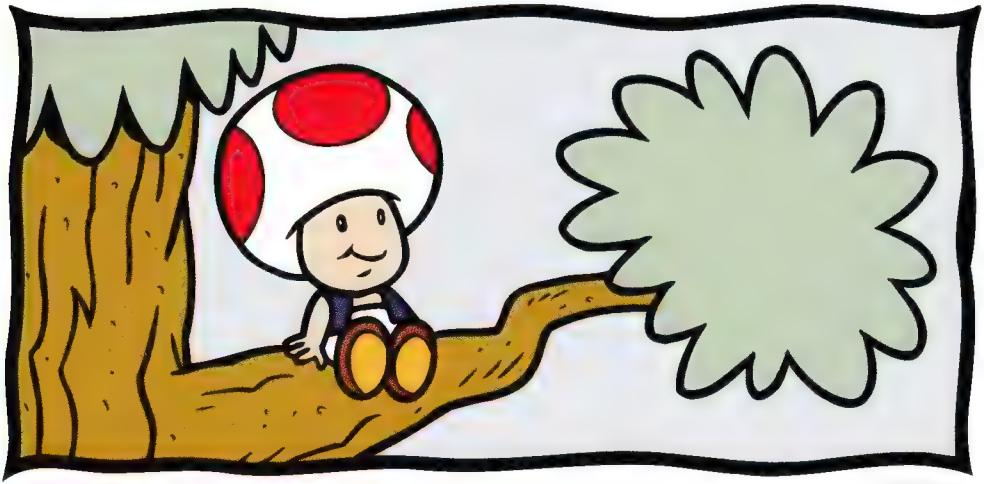


Illustration Gary Fields

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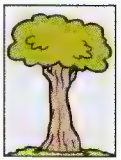
Leaves

Leaves convert nutrients into energy to help the plant grow. But they may serve other purposes besides producing food for the plant.

2 The main function of leaves is to produce food for the plant.



© M. Viard / Jacana

The holly plant's red berries attract birds, but their tough and thorny leaves keep animals from eating them.

Thorny leaves keep animals from eating a plant. Leaves with a glossy coating help plants retain water, which can keep them alive in dry climates or during drought. Modified leaves, called tendrils, curl around fences and other objects to anchor the plant and support its weight as it grows.

Other Adaptations

Pine needles are highly modified leaves with a tough outer layer called the cuticle. The cuticle and the waxy substance that covers it helps pine needles retain moisture. The thick leaves of succulent plants expand to retain water that can be used during dry spells. Some kinds of rhododendrons have leaves with velvety undersides to help retain moisture and make it hard for insects to cling to them. Palm trees have especially sturdy leaves that resist drying and breaking in strong winds.

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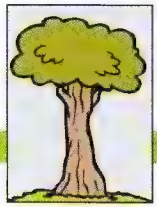
Where did azaleas originate?



PLANTS AND TREES

1. Africa and South America
2. Europe, Australia, and New Zealand
3. Asia, North America, and southern Europe

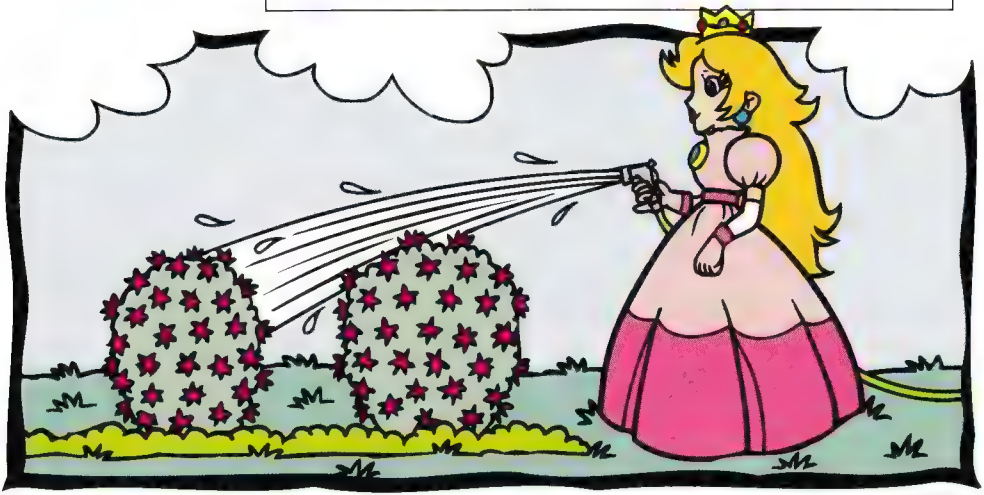


Illustration Gary Fields

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Azalea

Azaleas are a type of rhododendron. Today they are cultivated all over the world as decorative house and garden plants.

3 Azaleas are native to hilly areas of Asia, North America, and southern Europe.

© H. Berthoule / Jacana

Many types of azalea produce brightly colored, fragrant flowers. Smaller azalea varieties make wonderful houseplants.

Some types of azalea are evergreens, which do not shed their leaves every year, while others are deciduous plants. Azaleas prefer acidic soil and direct sunlight.

Azaleas exist in a wide range of sizes, with different growing habits and flower color. Some are small shrubs that grow close to the ground, while others grow to the size of small trees. Azaleas produce white, pink, dark purple, or yellow funnel-shaped blossoms that may be fragrant.

Azalea Types

Most of the nearly 850 types of azalea are cultivated, that is, they are bred by horticulturists. Some 700 of these types grow wild in northeastern India, Myanmar, and southwestern China. Another 300 or so are found in New Guinea.

The smooth, or sweet, azalea is common to North America. It is a shrub that produces fragrant white flowers and grows 10 to 20 feet (3 to 6 m) high.

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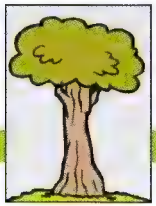
Which continent has the most rainforests?



PLANTS AND TREES

1. Africa
2. South America
3. Asia

Illustration, Gary Fields

©1996 Nintendo

Rainforests

The world's rainforests remained largely undisturbed until the 1950s. Today, they are disappearing at an alarming rate, as trees are cut down to make space for mining, grazing land, and crops.

2 South America has more rainforests than any other continent.

© Y. Tabaries

The map above shows the location of the world's large tropical rainforests (in dark green).

Rainforests and jungles are not the same. Rainforest refers to primary forest in tropical regions having an annual rainfall of over 70 inches (1.8 m). Jungles are regions of thick, scrubby vegetation that develop after primary rainforests have been destroyed.

Most of Earth's rainforest is located in the Amazon River basin in South America, in the Congo River basin in Africa, and in southeast Asia, especially Sumatra and New Guinea. Small areas of rainforest exist in northeastern Australia and Central America.

Destruction of the Rainforest

Although they cover less than 6 percent of Earth's land, the rainforests support up to three-fourths of all known plant and animal species. Vast areas of rainforest have been destroyed, and worldwide efforts are being made to preserve the remaining precious resource.

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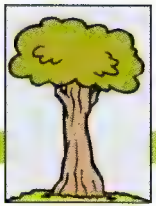
Is the tomato a fruit or a vegetable?



PLANTS AND TREES

1. Vegetable
2. Fruit
3. Both fruit and vegetable

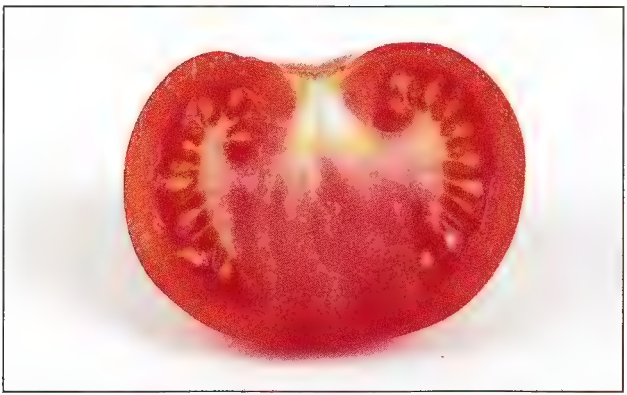
Illustration Gary Fields

©1996 Nintendo

Tomato

Tomatoes first grew in the Andes Mountains of South America, in the countries of Ecuador and Peru. They were probably cultivated in Mexico long before the arrival of European explorers.

2 The tomato is a type of fruit.



© Montenay / Sunset

Because tomatoes are not sweet like apples and bananas, you may think of them as vegetables. Strictly speaking, the tomato is a fruit, since it has seeds inside.

Tomatoes are one of the most widely grown commercial crops, cultivated in most regions of the world.

The many different varieties of tomato plants produce soft, succulent, red or yellow fruit ranging from the size of a berry to large, nearly round fruit 4 inches (10 cm) or more in diameter. The fruit also exists in pear-shaped and cherry-sized varieties. Tomatoes are a good source of vitamins A and C.

Growing Environment

Tomato plants grow best in relatively warm weather and full sunlight. They thrive in sandy, well-drained soil. Because tomato plants do not have very thick stems, they have a tendency to become top-heavy as they grow. Wire cages placed around the plants or wooden stakes placed beside them help keep them from falling over.

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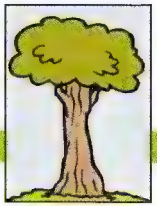
What is the name of the structure that encases peas on a plant?



PLANTS AND TREES

1. Sepal
2. Pod
3. Tendril

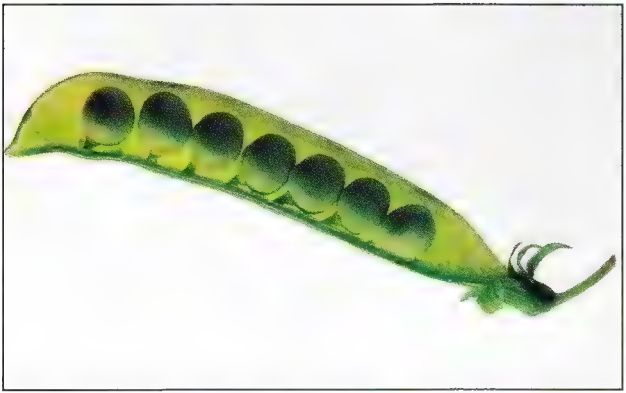
Illustration: Gary Fields

©1996 Nintendo

Pea

After flowering, pea plants develop into pods, each of which has a row of seeds inside. In some varieties of peas, the pod is edible.

2 **The structure that encases peas on a plant is called the pod.**



© Japack / Sunset

Each little round pea that you eat is actually a seed. Dried peas planted in the ground will sprout into new pea plants.

Peas are one of the oldest cultivated crops. Fossilized peas have been found in Swiss lake villages, and wild peas grew in Great Britain in medieval times. Peas were introduced to the U. S. during early colonial times. Today, they are grown almost all over the world.

Plant Characteristics

Pea plants are hardy, leafy annuals. They grow best in cool weather, when planted in a sunny spot with fertile, well-drained soil. Their hollow stems trail along the ground or climb up a support structure, such as a fence or trellis. Each stem grows up to 6 feet (1.8 m) long and ends in a curly tendril that wraps around nearby objects, anchoring the plant as it grows. Each stalk produces two to three butterfly-shaped white, reddish-purple, or pink flowers.

Most of the world's peas are grown in Europe and North America.

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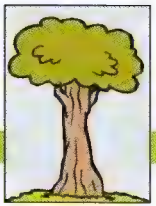
What does a flower's corolla consist of?



PLANTS AND TREES

1. All the sepals
2. All the petals
3. All the stamens

Illustration: Gary Fields

©1996 Nintendo

Flower

Flowers have many different parts: sepals, petals, pistils, and stamens. Each of these structures plays a distinct role in the plant's life cycle.

2 A flower's corolla consists of all its petals.

© Animals Animals / Sunset

When a bumblebee visits a flower to collect nectar, grains of pollen from the anthers stick to the bee's feet. As the bee moves around, the pollen on its feet falls onto the flower's pistil, pollinating the plant.

The sepals surround and protect the flower when it is still a bud. Often resembling tiny green leaves, they remain at the base of the flower after it blooms. In some plants, such as lilies and tulips, the sepals are colorful and showy, just like petals.

Petals vary from flower to flower. They may be flat, uniform blades, as in sunflowers, or ruffled clusters, as in carnations.

Floral Reproduction

The pistil, usually an upright structure in the center of the flower, produces ovules. Each ovule encloses an egg cell that can develop into a seed after fertilization. Stamens usually surround the pistil. Each stamen consists of a supporting filament and an anther, where pollen grains are produced. Pollination occurs when pollen grains shed by the anthers come into contact with the pistil. Eventually, these pollen grains reach and fertilize the ovules.

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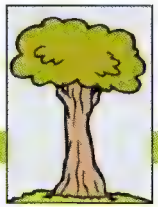
What is a citrus fruit?



PLANTS AND TREES

1. Fruit produced by trees in the genus *citrus*
2. Any fruit with an edible peel, such as apples
3. Sliced fruit processed with sugar

Illustration Gary Fields

©1996 Nintendo

Citrus Fruit

The word citrus refers to evergreen trees and shrubs in the rue family as well as the fruit they produce. Citrus fruits include oranges, lemons, limes, grapefruit, bergamots, citrons, shaddocks, and tangerines.

1 **Citrus fruits are produced by trees in the genus *Citrus*, which includes lemon trees.**

© Florida Department of Citrus

Bountiful Florida citrus groves help to quench our thirst for orange juice.

Citrus plants have purplish or white flowers and winglike extensions on each leaf stalk. Their fruit has a spongy or leathery rind and juicy pulp divided into sections. The leaves and flowers of the plant and the rind of the fruit secrete a pungent fragrance.

Unfamiliar Fruit?

You are probably familiar with oranges, lemons, limes, and grapefruit. But have you ever eaten a bergamot? Bergamots are pear-shaped oranges. Citrons are oval-shaped, yellow fruits measuring 7 to 10 inches (18 to 25 cm) long, with a rough, grooved rind. Shaddocks are very large, round, pale-yellow citrus fruits weighing from 10 to 14 pounds (4.5 to 6 kg). They have greenish, watery pulp that is often used in preserves. Both shaddocks and grapefruit are often called pomelos.

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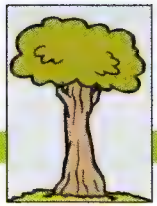
What are perennial plants?



PLANTS AND TREES

1. Plants that die after one growing season
2. Plants that survive through more than one growing season
3. Plants that grow only in tropical climates

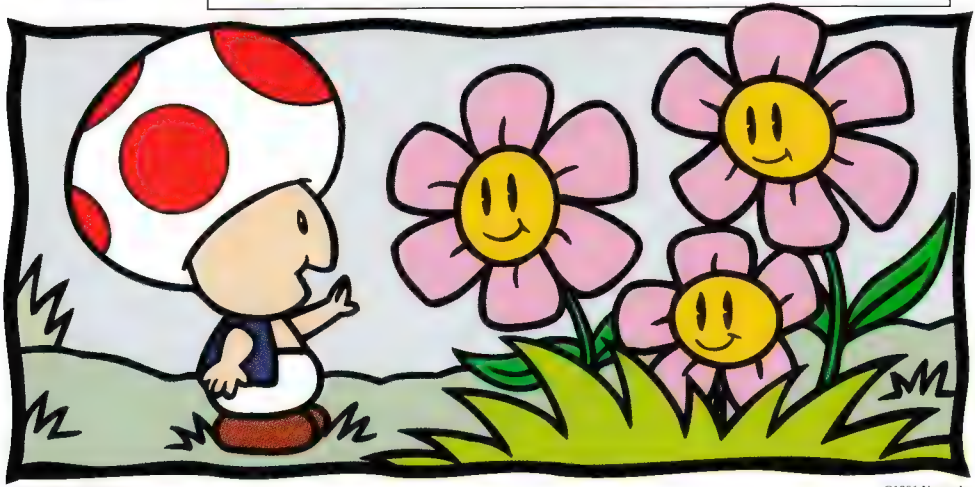


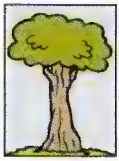
Illustration: Gary Fields

©1996 Nintendo

Perennials

Under favorable conditions, perennial plants grow back and increase year after year. Common perennial garden plants include delphinium, poppies, and violets.

2 Perennial plants survive through more than one growing season.



© S.T.F. / Sunset

Perennial garden plants grow best when they are thinned out and fertilized at least once a year.

Perennials usually die to the ground in cold weather but grow back when the weather warms up. Annuals live for only one season and are popular filler plants in gardens. Zinnias, petunias, and baby's breath are all annuals.

Biennial plants take two seasons to complete their life cycle. They do not produce flowers until the year after they are planted. Biennials are often in bloom during the early summer, when few perennials are in flower. Canterbury bells and some varieties of forget-me-nots are biennials.

Garden Care

Besides regular watering, there are many steps to caring for a garden. A hoe may be used to break up topsoil so that water can penetrate to the roots of plants and very tall plants may need to be supported by a wooden stake or grown against a trellis.

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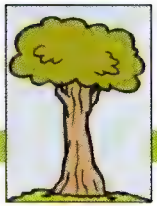
What is one benefit of growing plants in a greenhouse?



PLANTS AND TREES

1. Plants can be grown during the winter
2. No weeds will grow
3. Plants produce more flowers

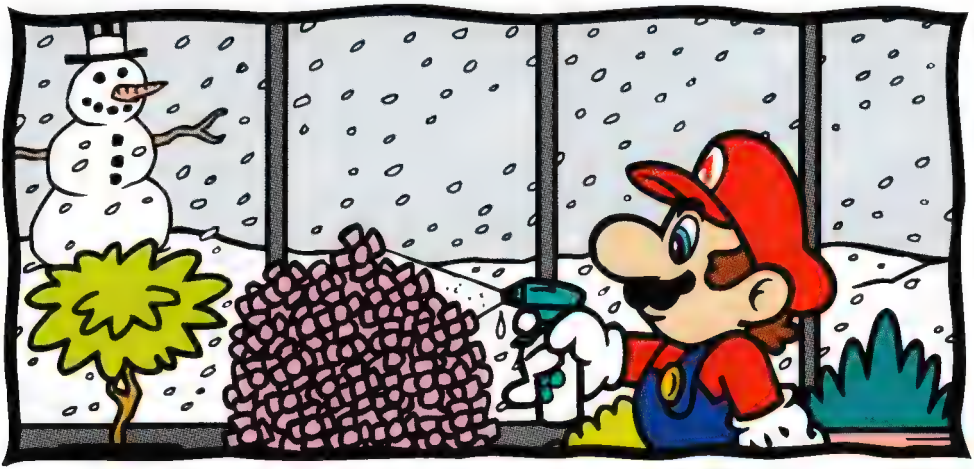


Illustration: Gary Fields

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Greenhouse

Most greenhouses have a transparent glass or plastic roof and sides that allow sunlight to penetrate. The light, temperature, and humidity inside a greenhouse can be controlled to suit the growth requirements of specific plants.

1 **In a greenhouse, plants can be grown during the winter.**

© Len Sirman

Greenhouses come in many different sizes. Small ones are suitable for home gardening, while vast structures are used to raise and display plants in garden nurseries.

In the northern hemisphere, plants inside a greenhouse usually get enough light from the Sun in spring and summer. During fall and winter, artificial light must be supplied.

In summertime, shades are drawn or the panes of the greenhouse are covered with white paint to reduce heat and light inside. Ventilators and fans provide additional air circulation. In the winter, sunlight provides most of the heat. Steam, hot-water, or hot-air circulating systems may also be used.

The humidity inside a greenhouse depends on the amount of water added to the soil in pots or to the dirt floor. Some greenhouses are equipped with a sprinkler system that automatically waters and mists the plants inside.

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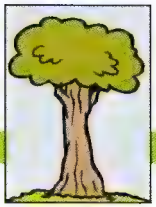
What is plant propagation?



PLANTS AND TREES

1. Pruning plants into fancy shapes
2. Growing new plants
3. Adding fertilizer to flowering plants

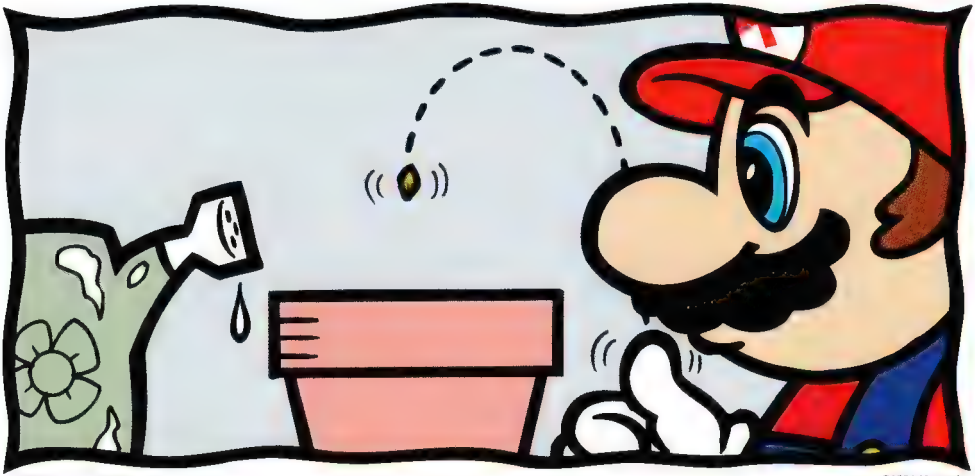


Illustration Gary Fields

©1996 Nintendo

Propagation

One way to start new plants is to sow seeds. New plants can also be started from the stems, leaves, or roots of existing plants.

2 Gardeners grow new plants using different methods of plant propagation.

© D. Cavagnaro / Visuals Unlimited

Some perennials, like these daylillies, are propagated by dividing their roots and replanting the smaller clumps.

Growing plants from seeds is the least expensive method of propagation. It is also very convenient, since seeds can be stored for long periods of time.

Stems, Leaves, or Roots

Vegetative propagation is starting new plants from the stems, leaves, or roots of existing plants. Stems cut from indoor plants, such as ivy or philodendrons, will form roots when placed in water like cut flowers. After roots have developed, the stems can be potted in soil.

Jade plants, succulents grown both indoors and outside, can be propagated by simply pinching off leaves and standing them base-down in soil. These leaves will eventually produce the roots and young shoots of a new plant.

Some plants, including strawberries and spider plants, grow long stems called runners. At the end of each runner is a tiny plant that will root when it is anchored in soil.

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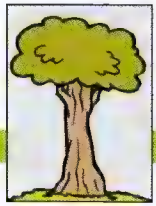
Where do maple trees grow?



PLANTS AND TREES

1. Tropical regions of South America
2. Temperate areas of the northern hemisphere
3. Deserts in the southern hemisphere

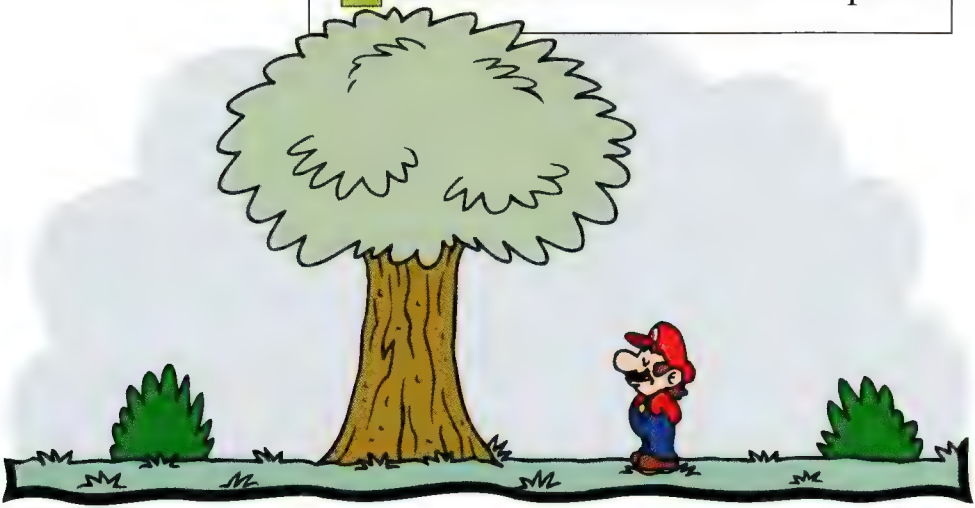


Illustration Gary Fields

©1996 Nintendo

Maple

With their thick foliage and rich autumn colors, maples are popular as ornamental and street trees. The most commonly grown maple is a medium to large deciduous tree with lobed leaves.

2 **Maple trees grow in temperate areas of the northern hemisphere.**

© Moulu / Sunset

Maples have lobed leaves. This means that they have several rounded projections, rather than a single blade.

There are about 113 species in the maple family. Sycamores, common in Europe, and box elders, native to much of the United States, are both types of maples. The most popular cultivated species include red maples, sugar maples, black maples, and Norway maples. All are native to North America and Europe. Most maples have lobed leaves and are deciduous, dropping their leaves in fall. All maple trees form seeds in pairs that are jointed at the base and have thin wings.

Maple Products

Besides being a popular ornamental tree, maples are also a good source of timber, especially the sycamore maple. Wood from sycamores is very strong and whitish in color, with a wavy grain. Sugar maples produce sugar and syrup.

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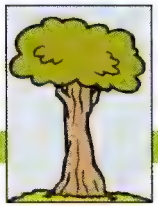
Why do flowers produce fragrance?



PLANTS AND TREES

1. To cover up bad smells in the air
2. To attract insects to pollinate them
3. To add to their beauty

Illustration, Gary Fields

©1996 Nintendo

Flower Fragrance

Flower fragrances attract pollinators, including bumblebees, butterflies, flies, and moths. Some flowers smell good. Others give off an odor similar to rotting flesh to attract the flies that pollinate them.

2 Flowers produce fragrance to attract the insects that pollinate them.

© J.P. Nacivet / Explorer

The rich colors and fragrances of some flowers make them attractive not only to the insects that pollinate them, but also to human admirers.

Flowers have fragrance because tiny quantities of essential oils from the petals are absorbed into the air. Many perfumes are made from flowers such as roses, violets, honeysuckle, lilac, and jasmine.

Flowers are cultivated especially for perfume in Turkey, Bulgaria, India, and Syria. The cities of Istanbul and Edirne, in Turkey, are famous for their production of attar, or essential oil, of roses.

Other Plant Odors

Fragrance may be produced by the leaves, as in sage, thyme, mint, and other herbs, or it may be produced by the bark, as in cinnamon and cassia. Some woods, including sandalwood and cedar, secrete strong odors. Seeds, such as caraway and anise, and roots, such as orris and ginger, also produce fragrance. Some fruits, including oranges and lemons, have aromatic rinds.

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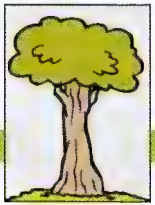
What type of plant is wheat?



PLANTS AND TREES

1. Succulent
2. Grain
3. Carnivorous

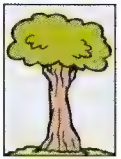
Illustration Gary Fields

©1996 Nintendo

Wheat

Wheat is the world's most commonly cultivated grain. Almost every day, somewhere in the world, a wheat crop is harvested.

2 Wheat is a grain.



© Len Sirman

Wheat is planted in the fall or spring and harvested in the summer.

Wheat is easy to recognize. It grows in tall stalks with long, thin leaves and hollow stems. The head of a wheat stalk is composed of groups of tiny flowerets. When the flowerets are fertilized they produce wheat grain, which is harvested and used whole or ground into flour.

Eat Your Wheat

There are thousands of different varieties of wheat, each with its own flavor and texture. Durum wheat is a hard wheat used to make pasta. Club wheat is a dry, soft wheat used for pastry flour. Bread wheat—the most commonly grown variety—is used for bread flour.

The Wheat Belt

The central portion of the United States and Canada is known as the Wheat Belt, because it's where most North American wheat is grown. The Wheat Belt stretches from the Canadian province of Alberta in the north 1,500 miles (2,400 km) to Texas in the south.

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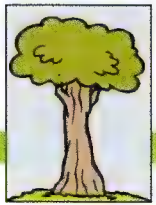
Which style of garden is based on natural growth of plants?



PLANTS AND TREES

1. English gardens
2. French gardens
3. Lithuanian gardens

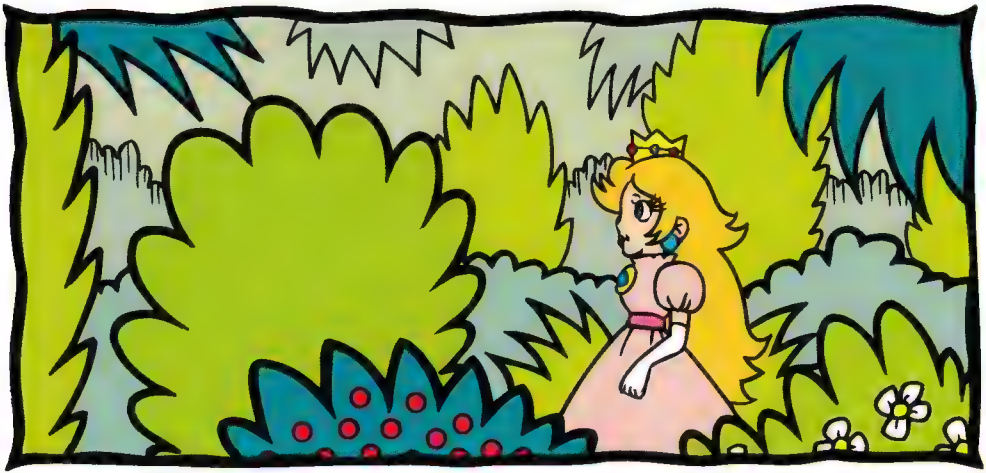


Illustration Gary Fields

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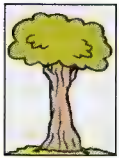
English Gardens

The English style of garden developed in the 18th century, prompted by a new interest in nature and natural laws.

1 English gardens are known for their natural, unsculptured style.



© Galia / Jerrican

English gardens are planted in unsculptured groupings of colorful, naturally shaped flowers and shrubs. Rocks, trees, and streams are incorporated into the gardens to make them appear more natural.

In the 1700s, people became interested in the idea of "natural laws" that governed human behavior. It was around this time that English philosopher John Locke wrote about basic human rights of life, liberty and the pursuit of happiness, which Thomas Jefferson adapted for the United States' Declaration of Independence. Natural laws occupied the thinking of everyone—even gardeners!

Natural and Untamed

Before the 18th century, gardens were formal and stylized. Plants and hedges were trimmed and sculpted into unnatural shapes. Plantings were made in orderly rows or patterns. But the 18th-century English style was different. It allowed plants to grow in bushy cascades and clumps of color. The style made it seem as if the plants were growing in the wild without human interference. This untamed, informal style showed appreciation of nature and people's basic natural freedoms.

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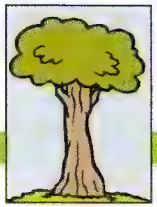
What is pruning?



PLANTS AND TREES

1. The method used to make plums into prunes
2. Propagating flowering plants
3. Removing branches to change a plant's shape

Illustration: Gary Fields

©1996 Nintendo

Pruning

Gardeners prune trees and shrubs to maintain their shapes and keep them healthy.

3 Trimming and shaping trees and bushes is called pruning.

© Gable / Jerrcan

Tree branches may be pruned to improve the tree's shape or increase its production of flowers or fruit. They may also be cut back to keep them from hanging over electrical wires or roofs.

The technique of pruning involves removing a plant's woody branches or stems. Sometimes pruning is done to improve a plant's appearance. Trees and shrubs need to be pruned to keep them looking neat. Gardeners also prune shrubs to "train" them to grow in particular shapes.

Pruning also helps plants produce more flowers or fruit. Removing dead or diseased branches means that the plant can send more nutrients to healthy, young branches to help them grow and flourish.

Pruning Season

Gardeners usually prune plants and trees after they have flowered. For low-growing shrubs, they use pruning shears and long, thin pruning saws. To trim tree branches, a gardener might use a limb cutter with a sharp blade attached to a long handle. The tools must be sharp so that the cuts are clean. Once it has been pruned, the plant naturally heals its cuts and continues to grow.

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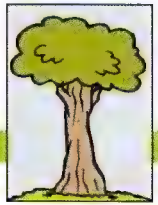
Which spice is generally the most expensive?



PLANTS AND TREES

1. Cinnamon
2. Nutmeg
3. Saffron

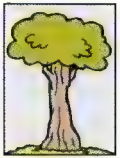
Illustration: Gary Fields

©1996 Nintendo

Saffron

Bright orange saffron is used for cooking, for dyeing fabric, and in cosmetics.

3 Just one pound of saffron can cost several thousand dollars!



© NHPA / Sunset

Saffron comes from the center portion, or stigmata, of the saffron crocus. It takes about 35,000 crocuses to make a pound of saffron.

Saffron costs so much because it's hard to grow and harvest. It comes from a variety of crocus flower that produces "threads" of saffron at its center. The threads are removed by hand and placed in a special oven to dry. The process takes a long time, and must be done carefully. It takes about 35,000 crocuses to produce a pound of saffron.

Ancient Luxury

Mixed with water, saffron makes a bright golden yellow dye which was used to dye fabric before chemical dyes were developed. In ancient India, women of upper classes, or castes, used saffron powder to dye their skin. Ancient Romans used saffron as perfume or air freshener. In France during the Renaissance, men and women colored their hair with saffron powder.

Today we use saffron as a cooking spice. It gives food a fragrant tang, and it's an important ingredient in Indian and Middle Eastern cooking.

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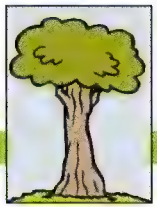
Which U.S. state grows the most oranges?



PLANTS AND TREES

1. Florida
2. Georgia
3. North Carolina

Illustration: Gary Fields

©1996 Nintendo

Oranges

The oranges in your orange juice probably came from Florida. It's our biggest orange-growing state, and almost all Florida oranges are used to make juice.

1 Florida grows the most oranges in the United States.

© Len Sirman

Oranges grow on evergreen trees with waxy leaves. The trees also produce orange blossoms—Florida's state flower.

Did you know that Christoher Columbus brought oranges with him to America? Spanish and Portuguese explorers were the first to plant orange trees in the New World. Oranges are native to Asia. Arab traders brought them to Middle East and southern European countries like Spain and Portugal. The Spanish and Portuguese liked the fruits so much, they carried them to their colonies in the New World.

Tropical Fruit

Oranges need the warm, humid weather and rich soil of the tropics to grow. It takes 3 to 6 years for an orange tree to bear fruit. Under the right conditions, orange trees can continue bearing fruit for 60 years, and some trees may live for more than 100 years. In some climates, ripe oranges are yellow-orange or deep orange. In other regions, a ripe orange may be yellow, or even green.

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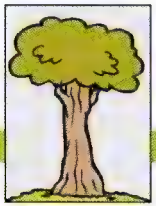
Which flower is the symbol of May Day in France?



PLANTS AND TREES

1. Lily of the valley
2. Rose
3. Snapdragon

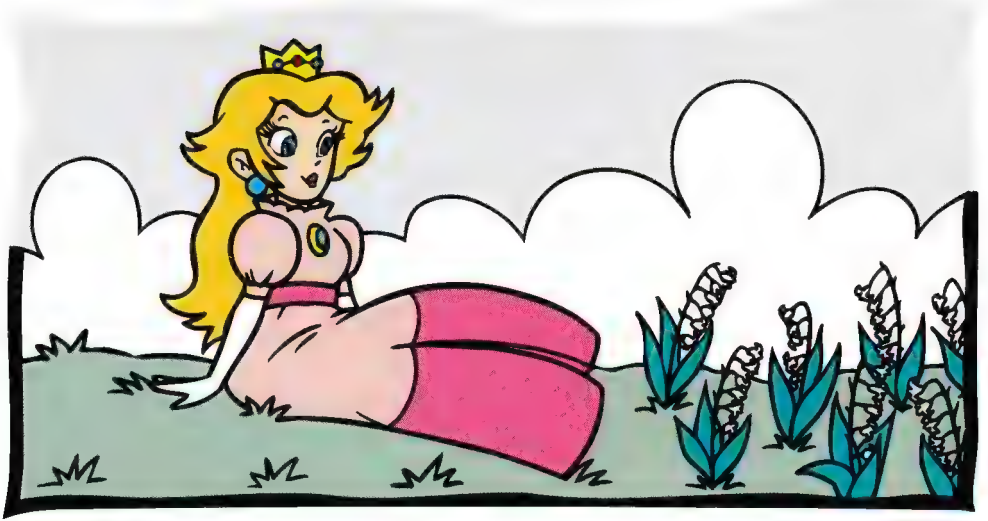


Illustration Gary Fields

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Lily of the Valley

In medieval times, monks called lily of the valley "ladder to heaven" because of the even step-like arrangement of its flowers.

1 **In France, people exchange lily of the valley plants on May Day.**

© Animals Animals / Sunset

The tiny, white, bell-shaped flowers of lily of the valley are easy to recognize.

Lily of the valley is easy to recognize because of the tiny, white, bell-shaped flowers which dangle from its stem. Its sweet fragrance has been a favorite perfume since the Middle Ages. People used to believe that the flower's scent attracted nightingales. A Norwegian legend says lily-of-the-valley was created when the spring goddess tore up her green dress and sprinkled it with snow. In Ireland the flowers are sometimes called fairy ladders because tiny fairies climb up and down them for fun.

Sign of Spring

Lily of the valley is also a traditional flower for bridal bouquets. It symbolizes the "return of happiness," probably because it blooms when spring returns.

Europe to the New World

Though lily of the valley grows wild throughout the northern United States, it came to us from Europe. French or English colonists probably brought plants with them when they came to the New World.

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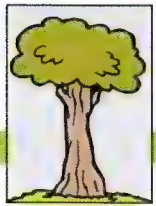
Do trees grow at the same rate all year long?



PLANTS AND TREES

1 Yes, trees grow at the same rate all year.

2 No, trees have a period of slow or no growth each year.

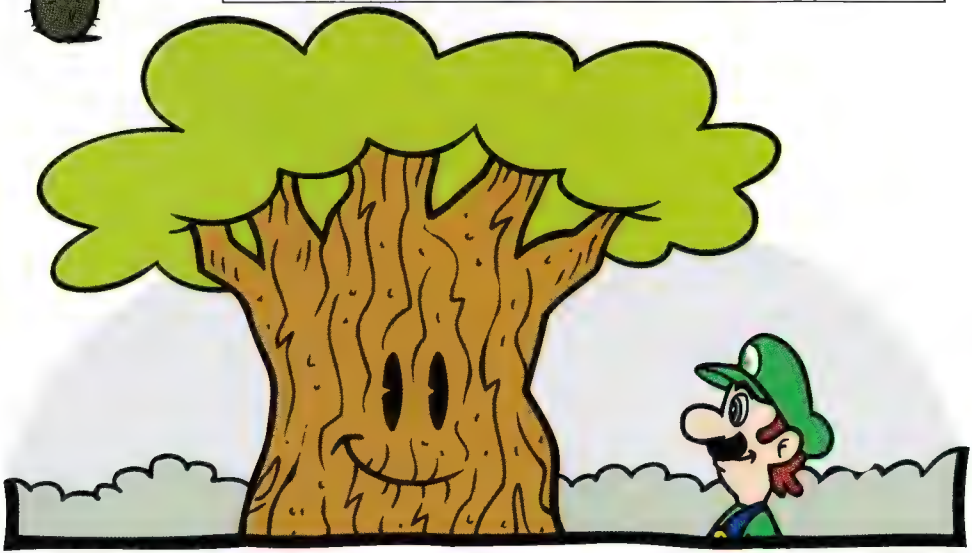


Illustration Gary Fields

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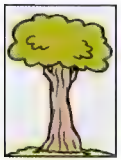
Tree Growth

A tree's growth cycle changes with the seasons. In cold weather a tree's growth slows or stops.

2 Most trees have a period of slow or no growth each year.



© Marge / Sunset

In winter, trees remain dormant, waiting for the warmth of spring when they can grow again.

A tree's growth begins in spring when it sprouts leaves. Some trees grow as much as an inch (2.5 cm) a day over a two-week stretch. Then the growth slows, and by early summer it stops completely. Others grow at a slow but steady pace through spring and summer—a period of three or four months.

Besides growing taller, each year a tree adds a new layer, or ring, of cells to the circumference of its trunk. You can tell the age of a fallen tree by counting these "age rings."

Dormant Days

In autumn, trees prepare for the next spring's growth. Deciduous trees—those that shed their leaves—sprout tiny leaf buds on their branches. They store nutrients and water, and then they wait. In winter, the buds are dormant, or still. If they sprouted, the cold would kill them. When the warmth of spring returns, the leaf buds sprout and the cycle begins again.

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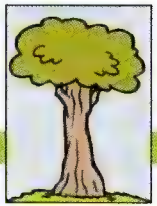
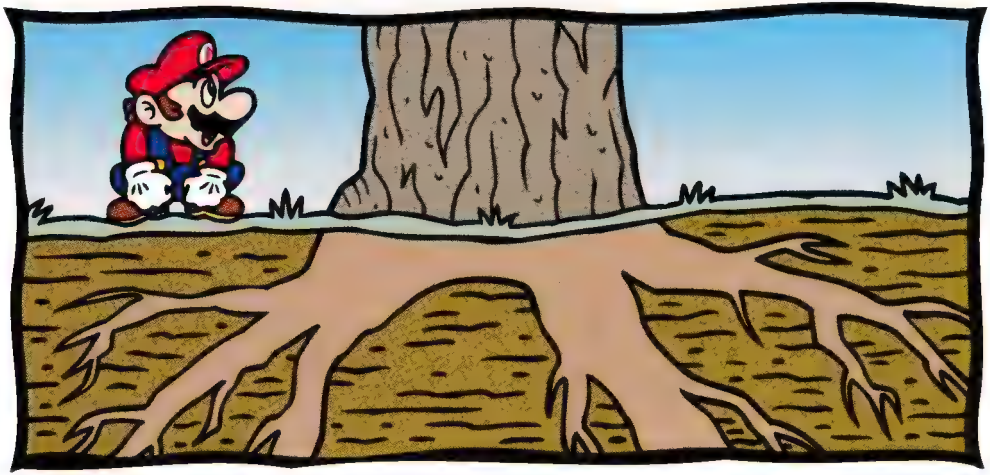
What is sapwood?



PLANTS AND TREES

1. A layer of cells that carries nutrients up from a tree's roots
2. Wood made from maple tree sap
3. Kindling made from very young trees



Illustration, Gary Fields

©1996 Nintendo

Sapwood

Trees have a kind of circulation system that carries nutrients to all their parts and helps them to grow. Sapwood is part of that system.

1 Sapwood carries nutrients up from a tree's roots.

© Len Stman

A tree's bark protects the heartwood and sapwood inside. If fungus or insects find their way beneath the bark, they can kill the heartwood leaving just the shell of a hollow tree.

Sapwood, also called the *xylem,* is buried deep within the trunk of a tree. It contains cells that draw water and nutrients up from the tree's roots and distribute them to the branches and leaves.

Heart of the Matter

At the center of the tree is the heartwood, which strengthens the tree. The sapwood, or xylem, is the layer of cells that surrounds the heartwood.

Through spring and summer, sapwood carries water and nutrients up from the tree's roots. During the fall and winter, the sapwood cells grow thicker and the flow of water slows. Eventually the sapwood becomes completely clogged. As sapwood cells clog and harden, they become part of the heartwood core. At the same time, a fresh outer layer of sapwood is formed and these new cells continue to deliver water and nutrients to the tree.

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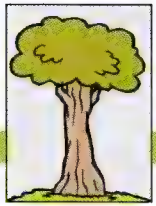
Why do some plants produce berries?



PLANTS AND TREES

1. Berries contain the seeds of new plants.
2. Berries hold juice needed for nutrients.
3. Berries are colorful and look pretty.

Illustration: Gary Fields

©1996 Nintendo

Berries

Plants have all sorts of ways to disperse seeds and form new plants. Some disperse their seeds in berries.

1 Berries contain the seeds of new plants.

© Goetzfeluck / Sunset

Bright red berries, like these holly berries, attract birds to plants. It's the plant's way of making sure its seeds are dispersed.

Pop a ripe berry into your mouth and you'll taste fruit pulp, juice, and tiny crunchy seeds. If those seeds were planted, they'd grow into new plants. Sometimes in the wild, berries fall from their tree, bush, or vine, and the seeds sprout in the ground near the plant. Soon there might be a cluster of bushes where once there was only one.

Help From Above

But how did the first bush arrive at that spot? The seeds had to come from somewhere. The answer lies with the birds.

Birds love berries. In fact, they eat so many that farmers who grow berries have to protect their crops with bird-proof cages.

Birds nibble on berry plants, then take off again. By the time the birds digest their meal they're far away. But the waste they excrete contains seeds from the berries they ate. Those seeds drop to the ground and sprout, producing new plants in a new location.

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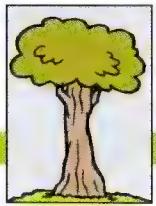
Which tree produces the largest pine cones?



PLANTS AND TREES

1. Arolla pine
2. Douglas fir
3. Sugar pine

Illustration: Gary Fields

©1996 Nintendo

Pine Cones

Cones of sugar pine trees measure about 20 inches (50 cm) long and can weigh as much as 4 pounds (1.8 kg).

3 **The sugar pine generally produces the largest pine cones.**

© Goetgheluck / Sunset

This is the cone of the Weymouth pine, found in the northeastern U.S. Though we called them "pine" cones, fir, spruce, cedar, cypress, and larch trees also produce cones.

Pine cones are like flowers. They carry pollen and seeds needed to produce new trees. Cone-bearing trees are called conifers.

Gender Specific

One tree produces male and female cones. Male cones contain pollen and female cones have ovules. Pollen and ovules come together to fertilize seeds for a new tree when wind carries pollen to the ovules on the female cone. Since it's impossible to know where the wind will carry the pollen, conifers produce thousands of female, or seed, cones to increase the chance of pollination.

Tasty Treats

Some conifer seeds are good to eat. Trailblazers in the Pacific Northwest munched sugar pine seeds. Hopi and Navajo Indians have harvested nuts of the piñon pine for ages. Piñons or pignoli nuts are also found in China and Italy. Italians use them in cookies and for a pasta sauce called pesto.

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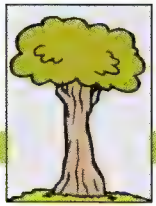
When did trees first appear on Earth?



PLANTS AND TREES

1. 300 million years ago
2. 200 million years ago
3. 100 million years ago

Illustration: Gary Fields

©1996 Nintendo

Forests

The first plants on Earth were ferns which grew in moist regions. They existed about 400 million years ago. It took another 100 million years for trees to develop.

1 The first forests appeared on Earth about 300 million years ago.

© Moulu / Sunset

Ferns were Earth's first plant life, but woody plants and trees were better adapted to life in different climates. In a forest today you'll see ferns and trees living side by side.

The ferns that grew on Earth in the Paleozoic Era were huge and leafy, and most of them thrived in damp soil near the banks of rivers. At that time, Earth was like a big fern-covered rain forest. The ferns had long, floppy leaves that stretched for yards, but they weren't very hardy. They couldn't live in drier climates and they couldn't grow too tall because their stems couldn't support their weight.

Evolution of Trees

As the plants evolved, the ones with strong, woody stems survived and weaker plants died out. Ferns died and decayed, and enriched the soil with nitrogen, carbon and other nutrients that allowed woody plants and trees to grow. The period of development that led from ferns to forests is called the Carboniferous period because much of the carbon-rich plant life of the time fossilized into the coal deposits beneath Earth's surface today.

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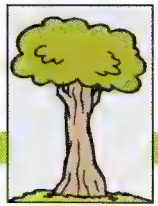
How does a tree distribute its nutrients?



PLANTS AND TREES

1. In its bark
2. In its fruit
3. In its sap

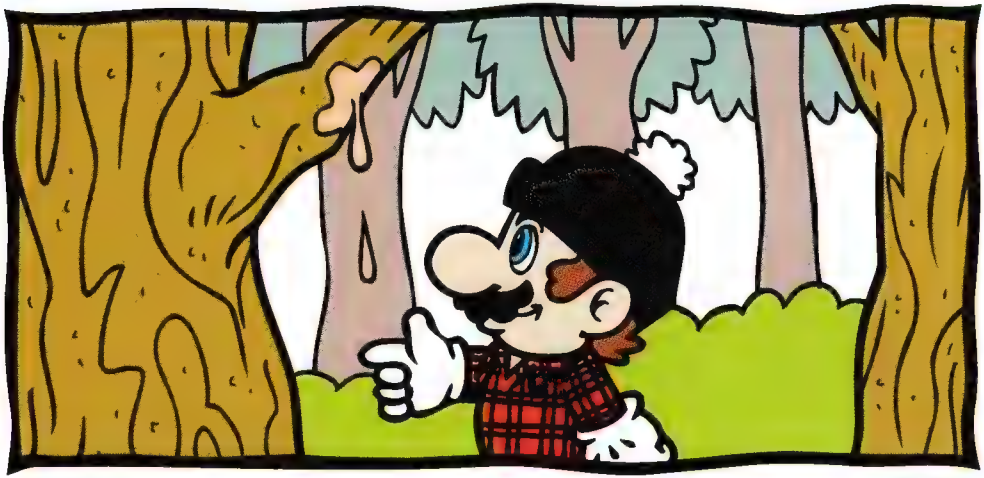


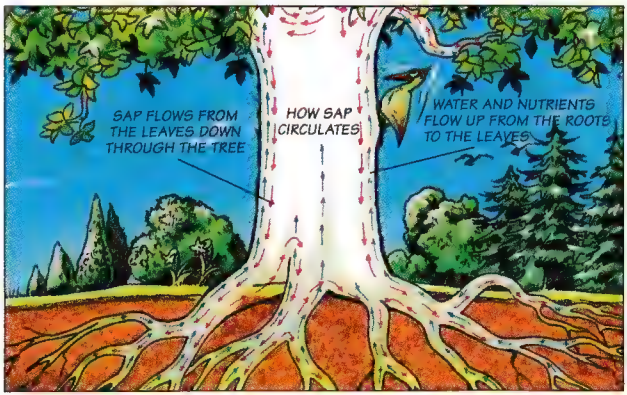
Illustration: Gary Fields

©1996 Nintendo

Sap

A tree's leaves work like little laboratories, converting raw nutrients into sugary sap.

3 The nutrients a tree needs to grow are distributed in its sap.


SAP FLOWS FROM THE LEAVES DOWN THROUGH THE TREE
HOW SAP CIRCULATES
WATER AND NUTRIENTS FLOW UP FROM THE ROOTS TO THE LEAVES
© Y. Tabarrés

Raw nutrients and water flow up from the roots to the leaves where they are combined with carbon dioxide and converted into sugary sap.

Like humans, trees need a source of energy to help them live and grow. Trees get energy from nutrients and water in the soil, which they convert into a fuel they can use. This conversion process is called photosynthesis.

Going Up

A tree's roots draw water and nutrients up from the soil. These raw ingredients are sucked upward through the tree trunk into the leaves by cells called the xylem or sapwood.

In the Leaves

Water and nutrients from the roots combine with the carbon dioxide leaves absorb from the air. Sunlight makes the mixture start churning. The carbon combines with hydrogen and oxygen from the water to produce a sugary liquid called sap. Extra oxygen is given off into the air.

Going Down

The sap then travels back down through the branches and trunk in cells called the phloem.

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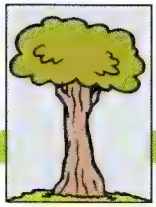
Do trees give off water?



PLANTS AND TREES

1 No, trees only absorb water.

2 Yes, trees give off water vapor into the air.

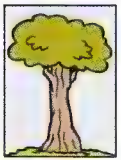
Illustration: Gary Fields

©1996 Nintendo

Transpiration

Leaves are covered with tiny pores, called *stomata*, that allow them to expel excess water. This process is called transpiration.

2 Trees give off water vapor into the air.



© Marge / Sunset

The air in a forest feels humid because the trees and plants give off water vapor.

Plants and trees need water to grow, but they don't use all the water they absorb from the ground. What they don't use is released into the air as vapor. One tree can give off gallons of water vapor in a day.

Super Suction

Imagine the inside of a tree as a system of pipelines running from the roots to the leaves and back again. "Pipelines" of cells carry water to the leaves, but the water won't flow upward by itself (that would defy gravity!). It needs a force to pull it upward. The release of water vapor in transpiration creates the suction to draw the water upward.

How Dry I Am

The amount of water released in transpiration varies by climate. Plants in humid, tropical rain forests have huge flat leaves that give off a lot of water vapor. Plants in dry areas, have thick waxy leaves that limit the amount of water released in transpiration.

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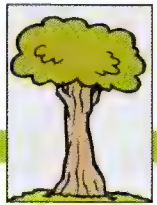
Do farmers grow Christmas trees?



PLANTS AND TREES

1 Yes, some Christmas trees are grown on farms.

2 No, farmers only grow food crops.

Illustration: Gary Fields

©1996 Nintendo

Tree Farms

Tree farms also grow seedlings which are later replanted in forests. They may also cultivate trees for use by gardeners and landscapers.

Each year, huge numbers of trees are cut down to provide wood for construction and wood pulp used to make paper. New trees have to be planted to replace the ones that have been felled. Otherwise we'd run out of trees to supply our needs, and we'd soon be living in a world without trees! That's where tree farms come in.

Life on the Farm

It takes a long time for a tree to grow to maturity.

1 **Some evergreens used as Christmas trees are grown on farms.**

© Naouet J.-P / Explorer

Tree farms produce a supply of young seedlings that are eventually replanted into forests.

Tree farms give young trees a head start. On a tree farm, thousands of seeds for new trees are planted in long, wide rows. Then they're tended, like any crop. They're watered and fertilized and protected from disease. When the trees are large enough, they're transplanted into forests.

Other tree farms grow trees as cash crops, the way some farmers grow corn or carrots. These trees may eventually be sold at nurseries and garden centers.

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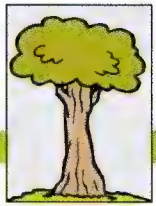
When a tree dies in the forest, does it help or hurt the soil?



PLANTS AND TREES

1 Helps

2 Hurts

Illustration, Gary Fields

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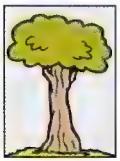
Decomposition

When a tree dies, its structure slowly breaks down into nutrients that feed the soil. This process of breaking down is called decomposition.

1 When a tree dies in the forest, it helps the soil.



© Bohin J.-L. / Explorer

A dead tree enriches the soil with nutrients that help other trees grow.

Trees can live healthy, productive lives for hundreds of years. A tree generally dies a "natural" death only when it is the victim of a force of nature. Lightning, strong winds, disease, or insect infestation are the primary reasons that a healthy tree dies and falls to the ground.

Life After Death

Strange as it may seem, dead, rotting trees are an essential part of what keeps a forest alive and thriving. At first, a fallen tree trunk might become a home for forest animals or insects. As they burrow in, or feed on, the dead tree, they help to break the tree into smaller and smaller pieces. Rain and moisture help by softening the wood.

All the while, the dead tree is releasing the nutrients it contained while it was alive. Over time, the nutrients are absorbed into the forest soil. They'll be used by other trees to help them grow healthy and strong.

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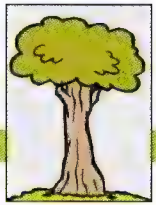
What is deforestation?



PLANTS AND TREES

1. Hunting in the woods for food
2. Planting trees
3. Clearing trees from land

Illustration, Gary Fields

©1996 Nintendo

Deforestation

Land is cleared of trees to make way for roads or buildings. Trees also are cut down to provide timber for construction, but clearing too many trees can cause environmental problems.

3 Deforestation is clearing trees from a parcel of land.

© Delabre P. / Explorer

Chopping down trees to make way for new roads and buildings is known as deforestation. When deforestation is done on a large scale, it becomes a threat to Earth's environmental balance.

Centuries ago, most of North America was covered by forests. Settlers chopped down many of these trees to clear the land for towns, roads, and later, railroads. Slowly, ancient forests became smaller and smaller. At the time, people didn't realize the longterm effects of deforestation.

Deforestation Problems

With fewer trees, the environment suffers. Trees help Earth by absorbing carbon dioxide from the air and giving off oxygen humans and animals need to breathe. They provide shade and help soil retain moisture so all plants can grow. They also provide homes for birds and animals. If the forest habitat is destroyed, these species could die off. This is why deforestation is often followed by "reforestation," in which new trees are planted to replace those that were cut down.

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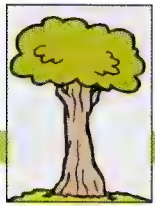
Which is the art of cultivating gardens?



PLANTS AND TREES

1. Horticulture
2. Pharmacology
3. Viticulture

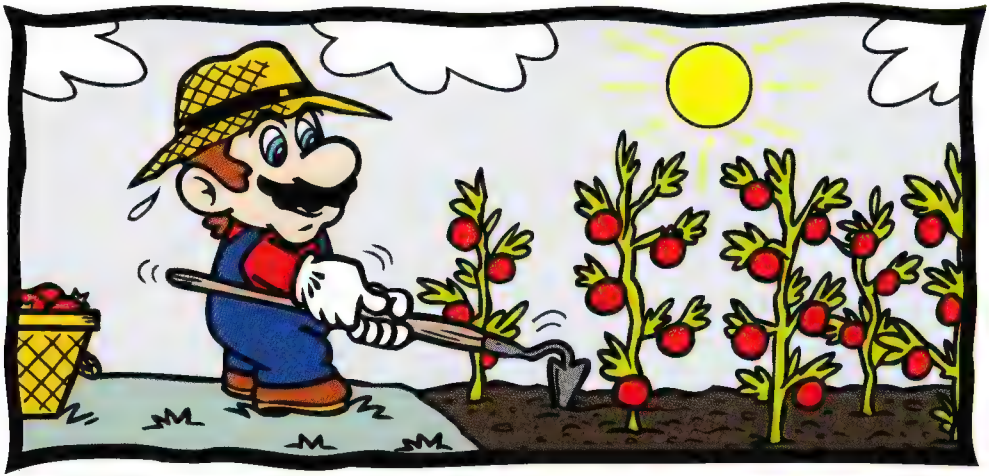


Illustration Gary Fields

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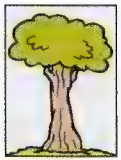
Horticulture

People who study horticulture are called horticulturists. They don't just grow garden plants, they work to develop new plant varieties.

1 Horticulture is the art of cultivating gardens.



© Fichaux / Sunset

Plants developed by horticulturists are grown in greenhouses like this one. From the greenhouse the plants are sold to farmers, landscapers, or garden centers. Eventually, many of the plants are planted in home gardens.

Horticulturists generally specialize in a particular category of plant—fruits, vegetables, flowers, or trees and shrubs. It's possible for a horticulturist to devote his or her entire career to the study of tomatoes or marigolds, for example. The specialty of growing and cultivating grapes is called viticulture. Work done by viticulturists is extremely important to the wine-making industry.

Bigger, Better Plants

The horticulturist's goal is to develop healthy and productive plants that are useful to farmers and home gardeners. They sometimes do this by breeding together two different varieties of the same plant to create a new plant, known as a hybrid. The hybrid combines the best characteristics of its "parent" plants. Some hybrids are bred for resistance to disease. Others are bred for the size of their fruit, or for color or appearance.

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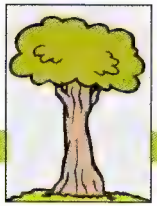
Do all plants reproduce on their own?



PLANTS AND TREES

1. Yes, all plants are capable of reproducing on their own.
2. No, some plants cannot reproduce on their own.

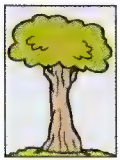
Illustration: Gary Fields

©1996 Nintendo

Pollination

For a plant to reproduce, male plant parts must fertilize female plant parts. Some plants contain both male and female parts which fertilize each other. This is called self-pollination.

2 Some plants cannot reproduce on their own.



© Holt Studios / Sunset

Fruit trees, like this one, usually pollinate themselves. Other types of flowering plants must be pollinated by other plants of the same species.

Other plants are only male or only female and they must be fertilized, or pollinated, by other plants of the same species. This is called cross-pollination.

Male plant parts, called anthers, produce tiny particles called pollen. The pollen must come in contact with the eggs, or ova, produced by the female plant part, called the ovary. When the male cells in the pollen mix with the female cells in the ova, they cause new flowers to grow.

Borne on the Wind

Once the pollen is produced it usually has to be carried by artificial means to the ovule. Sometimes the wind blows the sticky pollen grains to the ovule. Bees, birds, and even animals like bats also carry pollen from plant to plant. The pollen grains simply stick to the animal's skin and then fall off when the animal brushes against another plant.

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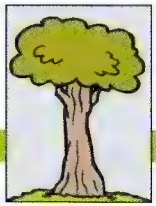
How do ferns reproduce?



PLANTS AND TREES

1. Their flowers are fertilized by bees.
2. Their spores produce new leaves.
3. New seeds must be planted by botanists.

Illustration Gary Fields

©1997 Nintendo

Ferns

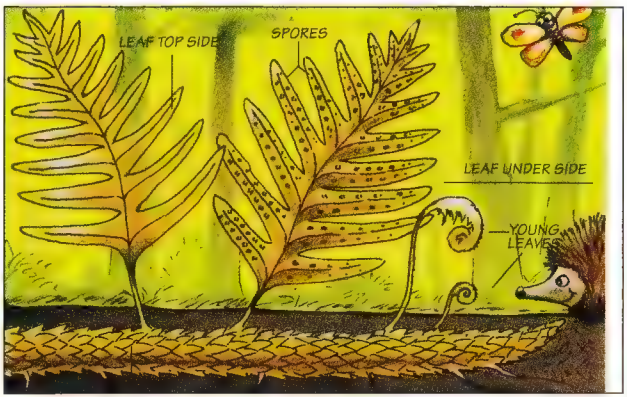
Before there were trees on Earth, there were ferns. Some of the earliest plant fossils found by geologists are from huge ferns that grew more than 400 million years ago.

Ferns are found all over the world, except in extremely cold regions. They especially like humid tropical areas where the soil is rich and wet, and there are trees to provide shade. Most ferns grow best in shady areas.

Making New Fronds

When a mature fern is ready to reproduce it doesn't produce seeds or flowers. Instead it develops clusters of spores on the underside of its leaves. The spores look like little brown dots. They are released from the leaves and fall to the ground. The spores are so small, you'd never know they were there, but once they hit the moist, warm ground they begin to grow.

2 The spores of a fern produce new leaves.



© Y Tabarés

The leaves of ferns grow from underground stems called rhizomes. Young leaves are tightly curled. They're sometimes called "fiddleheads." The rhizome is held in place by tiny roots.

Within each spore is all the genetic material needed to make a new plant. The spores sprout tiny roots to draw nourishment from the soil, and they begin to grow into new plants.

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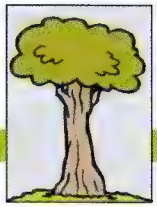
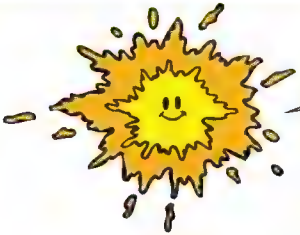
Which is an aquatic plant?



PLANTS AND TREES



1. Water Lily
2. Water Moccasin
3. Water Sprite

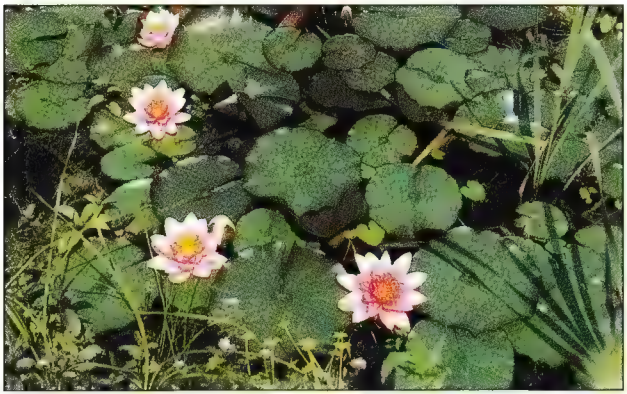
Illustration: Gary Fields

©1997 Nintendo

Water Lily

The leaves and flowers of the water lily float on the surface of ponds and quiet streams. The plant is anchored to the muddy bottom by thick, fleshy underwater stems.

1 Water lily is an aquatic plant.



© Reinhard / Sunset

French Impressionist artist Claude Monet is famous for his paintings of the water lilies in his water garden. They looked like these delicate pink flowers.

Water lilies grow in shallow, fresh water. Most plants produce flowers that are about 3 to 5 inches (8-12 cm) across, but the flowers of the Amazon water lily of South America, can grow to be 18 inches (45 cm) across. The plant's leaves have a waxy texture that keeps them from becoming saturated with water. Some water lilies have a sweet fragrance, others have none. Flowers may be white, yellow, pink, or blue.

Legends of the Lilies

Water lilies and their cousins, lotus flowers, are the source of a number of legends and beliefs. In India, one legend says that the water lily was once a star that fell to Earth and became a flower. In China, the lotus is a symbol of purity. It is also a symbol of immortality, probably because the flowers can survive even when their water source has dried up.

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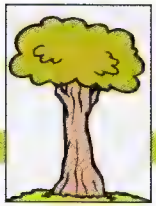
Where does vanilla come from?



PLANTS AND TREES

1. Orchids
2. Pine cones
3. Tree bark

Illustration, Gary Fields

©1997 Nintendo

Vanilla

A certain type of orchid produces pods known as vanilla beans. The pods were first cultivated by the Aztecs of Mexico. They used vanilla to flavor a drink made from chocolate.

1 Vanilla comes from orchids.

© McCormick Schilling Spices

A plantation worker tends to an orchid. The artificially pollinated flower will last only one day. Then it will produce a seed pod or "vanilla bean."

Today vanilla still enhances the flavor of chocolate. Read the ingredients list of your favorite chocolate candy and you'll find vanilla or vanillin, an artificial vanilla flavoring.

Harvesting the Pods

Most of the world's vanilla comes from the African island of Madagascar. Pods grow 6 to 10 inches (15-25 cm). When they're picked, the pods are yellowish. They're boiled in water for a few seconds, then wrapped in blankets to "sweat." During the day, they're set in the sun to dry. At night they're wrapped again. This goes on for months, until the beans are dark brown and about one-fourth their original size.

The beans are sometimes used whole or chopped in cooking. Usually, they're used to make a flavoring called vanilla extract, which is an ingredient in many desserts.

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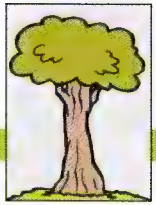
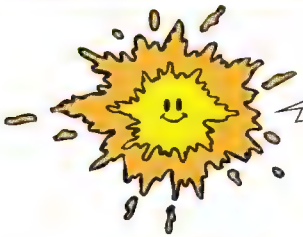
Where are most of the world's jungles?



PLANTS AND TREES



1. Argentina
2. Australia
3. Southeast Asia

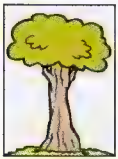
Illustration: Gary Fields

©1997 Nintendo

Jungle

Most people use the terms "jungle" and "rain forest" interchangeably, but there are differences between the two.

3 Most of the world's jungles are in southeast Asia.



© Sunset

The word jungle comes from the Sanskrit word *jangala,* meaning "wild," and the Hindi word *jangal,* meaning "wasteland."

One difference between a jungle and a rain forest is the way the plant life grows. Rain forests tend to have tall trees with a high canopy of leaves and branches. Jungles are densely packed with low-growing plants. This means you can probably walk easily through most parts of a rain forest, but you have to hack your way through most parts of a jungle.

Productive Rain Forests

Some naturalists distinguish jungles from rain forests by the types of vegetation they contain. Rain forests generally have mature trees which produce rubber, coffee, nuts, and other commercial products. Jungles are full of vines and underbrush. It is sometimes said that a jungle develops after the mature trees of a rain forest are cut down.

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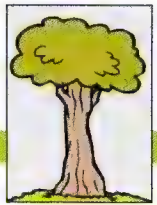
Which is *not* something that forests do?



PLANTS AND TREES

1. Cause soil erosion
2. Increase oxygen supply
3. Provide building materials

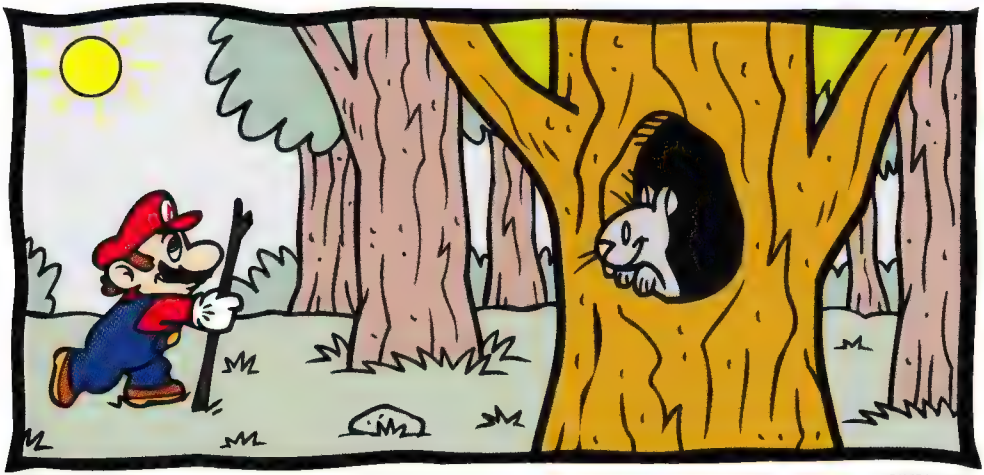


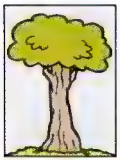
Illustration: Gary Fields

©1997 Nintendo

Forest

The trees and plants in a forest help to prevent soil erosion. This is just one of the many benefits of forests.

1 Forests do not cause soil erosion.



© Len Sirman

The trees in forests also provide humans with wood which is used as heating fuel and building material.

Forests benefit humans, and life on Earth, in dozens of ways. How many benefits of forests can you think of?

Call it Home

Trees, plants, and soil of a forest provide an environment in which thousands of creatures live. Without forests, many animals and birds would be homeless.

Breathe Deep

Forests help life on Earth by providing oxygen for animals to breathe. Trees and plants absorb the carbon dioxide that animals exhale, and give off oxygen that animals inhale.

Save the Soil

If it weren't for forests, Earth's soil would continually be wiped away by wind and rain. But the leaves on the trees slow the wind so it doesn't sweep violently across the land, and they slow the falling rain so that it doesn't wash away the soil. The trees' root systems absorb water from the soil so it doesn't stay muddy.

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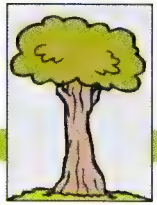
Which is a fungus that people eat?



PLANTS AND TREES

1. Honey fungus
2. Smut
3. Truffles

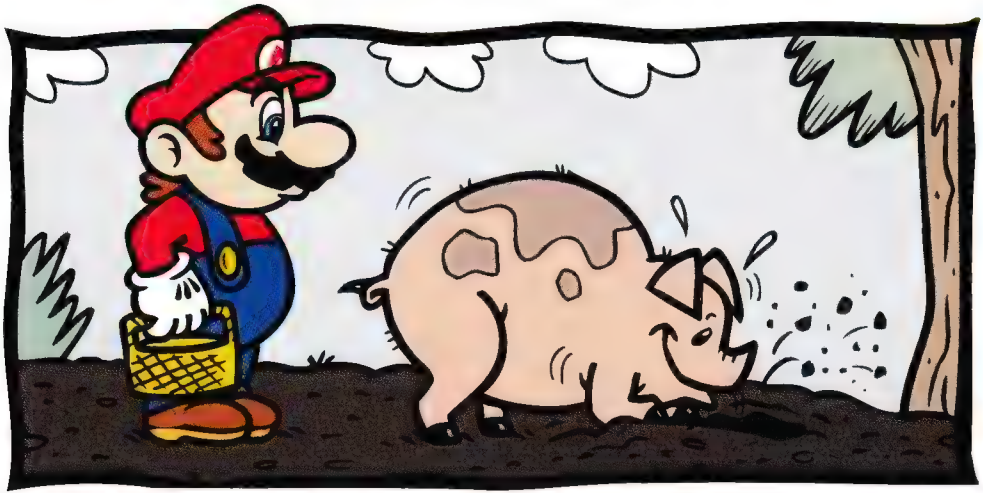


Illustration Gary Fields

©1997 Nintendo

Fungi

Truffles are a type of fungus that grows underground. They're considered a delicacy because they're hard to find. People in France, Italy, and England use dogs and pigs to sniff out truffles.

3 Truffles are a fungus that people eat.

© Sunset

Fungus is a type of parasite—an organism that lives off other organisms. The fungi in this picture are drawing nutrients they need to live from a living tree.

Fungi (the plural of fungus) are strange organisms. They're not plants, but they look like vegetation. They're not animals, but they feed on other organisms the way animals do. Fungi are classified into two groups depending on whether they feed on living or dead organisms. The organisms upon which the fungi grow are called hosts.

Wanted: Dead or Alive

Fungi produce enzymes which digest the host organism. As the fungus sucks up nutrients that help it survive and grow, it weakens the host. This can be beneficial if the fungus feeds on dead matter. Then it's helping to decompose the dead organism. But if the fungus feeds on living plants or animals it can make the living organism so weak that it eventually dies.

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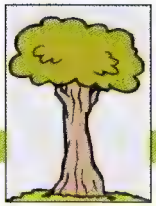
What is a plantain?



PLANTS AND TREES

1. A cactus flower
2. A type of banana
3. A tuber

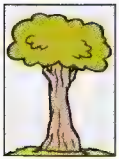
Illustration Gary Fields

©1997 Nintendo

Plantain

Though they look like large, flat bananas, plantains aren't sweet. They have a starchy consistency, similar to potatoes.

2 A plantain is a type of banana.



© Envision

Can you tell the two varieties of banana apart from the plantain?

Plantains grow in bunches on bushes, the way bananas do. Like bananas, plantains are harvested when they're green. They ripen to a yellow color off the bush. Plantains generally grow to be at least 1 foot long (30 cm) and 2 to 3 inches in diameter (5-7.5 cm).

Both plantains and bananas grow best in hot, humid climates. They're a main crop in Latin America and the Caribbean. In Spanish, they're called *platanos*.

Side Dish

Plantains are a common side dish in Latin American and Caribbean cooking. They're peeled and sliced lengthwise or horizontally. Then they're fried, roasted, baked, or boiled. They have a soft texture and mild flavor, like potatoes. Plantains may also be dried and ground into a meal that is used to make bread or to thicken soups and sauces.

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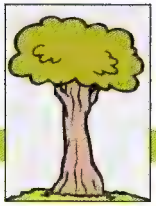
What does a gardener mean by "deadheading"?



PLANTS AND TREES

1. Adding mulch to soil
2. Removing flowers that have finished blooming
3. Watching TV instead of pulling weeds

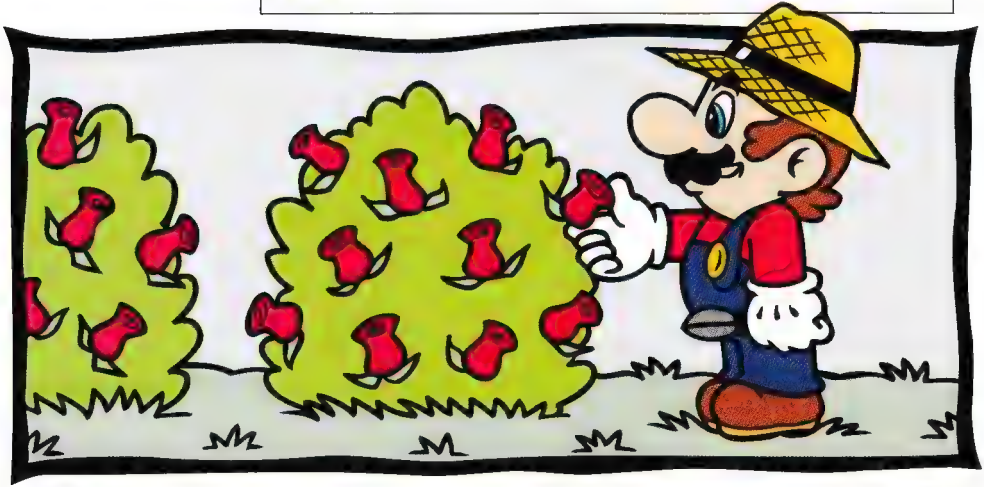


Illustration Gary Fields

©1997 Nintendo

Deadheading

By deadheading flowering plants, a gardener helps the plants grow.

2 Deadheading is removing flowers that have already bloomed.

© D. Clement / Explorer

Gardeners always wear gloves to protect their hands from thorns when they're deadheading rosebushes. Special pruning shears are used to make straight, clean cuts in the plant stem.

Removing the dead flower heads triggers the plant to channel its energy into growing taller or bushier rather than producing new seeds. Most gardeners feel that plants look best, and are healthiest, when they are full and neat.

Rose is a Rose

Some gardeners are rose specialists. They love the beautiful, scented flowers and grow as many varieties as they can in their gardens. Deadheading is a common practice for rose gardeners—because it helps the plants grow and because removing the dead blossoms makes the elegant plants look more attractive.

Self-Sowing

Gardeners may deliberately leave dead blooms on the plant. This is done so that the old flowers will drop their seeds to the ground beside the plant. The seeds will take root and produce new plants in the next growing season.

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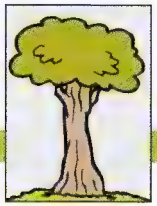
Which scientist studies plants?



PLANTS AND TREES

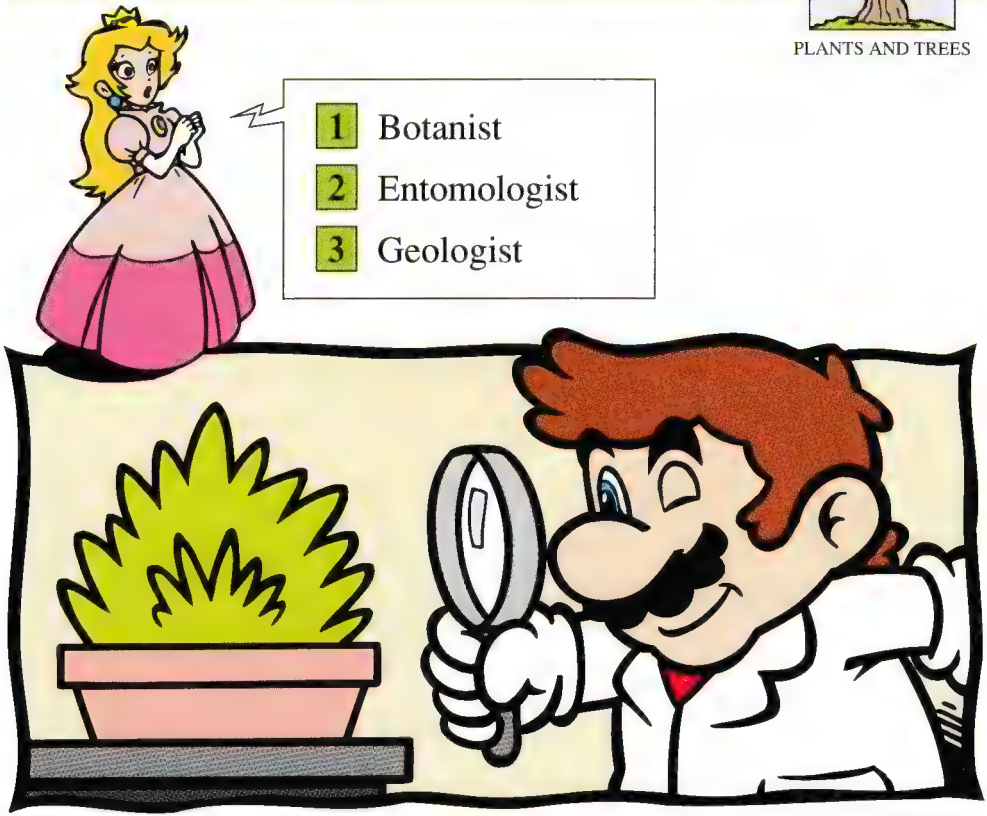


Illustration Gary Fields

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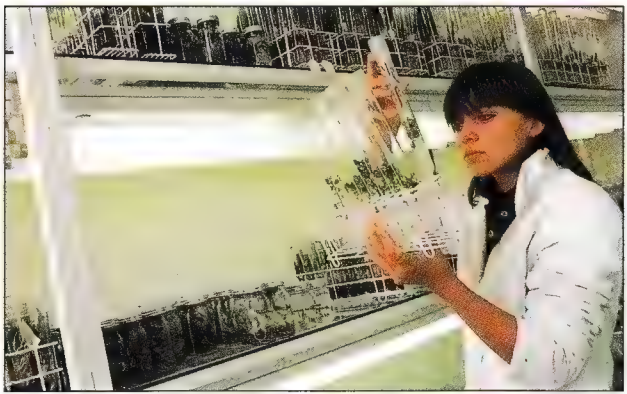
Botany

Botanists study how plants and trees live and grow. They also classify and categorize different species of plants by physical characteristics.

1 A botanist studies plants.



© Weiss / Jerrican

Botanists study the physical characteristics of plants, their uses, and their diseases.

Botany developed from the practice of medicine. In the ancient world, herbalists and doctors carefully studied plants to find the ones that could be used to make medicines and cures for various diseases and ailments. In the course of their work, they drew detailed pictures of the plants, labeling each by name and use.

Carolus Classifies

In 1753, Swedish scientist Carolus Linnaeus started a system of classifying plants and animals by scientific names. This prompted an interest in finding and classifying every type of plant on Earth.

Modern Science

Today, botanists still classify plants by physical characteristics and chemical compositions. They investigate new uses for plants, and they develop cures for plant diseases that affect agricultural crops.

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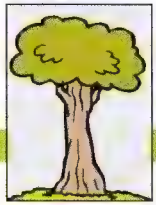
Which person designs public parks and gardens?



PLANTS AND TREES

1. Governor
2. Landscape architect
3. Pomologist

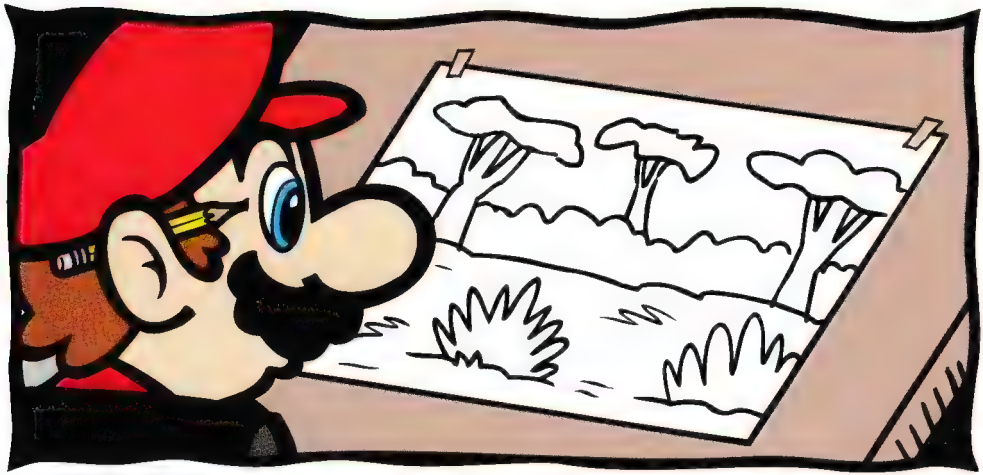


Illustration: Gary Fields

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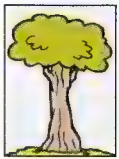
Landscape Architects

The art of landscape architecture has existed for centuries. Early landscape architects were hired by wealthy people to design their private gardens and estates.

2 A landscape architect designs public parks and gardens.



© Marge / Sunset

The gardens at the palace of Versailles in France were created by the landscape architect Andre le Notre in the 17th century. They include lovely manicured plantings like these, as well as a water garden and more than 200 statues.

The great 18th-century English landscape architect, Capability Brown, created the gardens and parks of country estates such as Chatsworth, the home of the Duke and Duchess of Devonshire. In addition to plantings of flowers and shrubs, landscape architects incorporate pools and fish ponds, statues, and other structures into their designs. It also was common to include a maze lined by tall, neatly trimmed hedges, in many gardens.

Public Service

Today, landscape architects work mostly on public parks and open spaces. They may also design grounds for public buildings such as college campuses or industrial complexes.

A landscape architect's job includes everything from conceiving the original design for a project, to selecting the plants and trees, to hiring the gardeners and construction workers to build the project.

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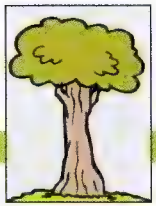
Who was John Muir?



PLANTS AND TREES

1. American naturalist
2. Canadian agriculturist
3. English botanist

Illustration Gary Fields

©1997 Nintendo

John Muir

Muir Woods National Monument in California and Muir Glacier in Alaska are named for John Muir.

1 John Muir was an American naturalist.

© WATC / Sunset

John Muir's legacy is the Sierra Club, an organization dedicated to preserving nature and wildlife, which he founded in 1892.

John Muir (1838-1914) was born in Scotland and emigrated with his parents to Wisconsin when he was 11. As a boy, he loved being outdoors. By the time he got to college, he was eager to study natural sciences like botany and geology, but he didn't have much interest in anything else. So, he left college and embarked on a remarkable journey.

Step by Step

Muir walked from Indiana to the Gulf of Mexico. He kept detailed journals of his year-long trek. From there he went to California, where he lived alone in the Yosemite Valley for six years, studying plants and animals of the region. After traveling to Nevada, Utah, and Alaska, he finally settled in northern California. From there, he campaigned for the U.S. government to make Yosemite a national park. In 1890, his request was granted.

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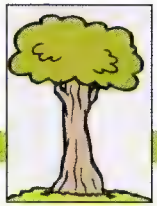
Who designed the gardens at Versailles?



PLANTS AND TREES

1. Charles de Gaulle
2. Andre Le Notre
3. Marcel Marceau

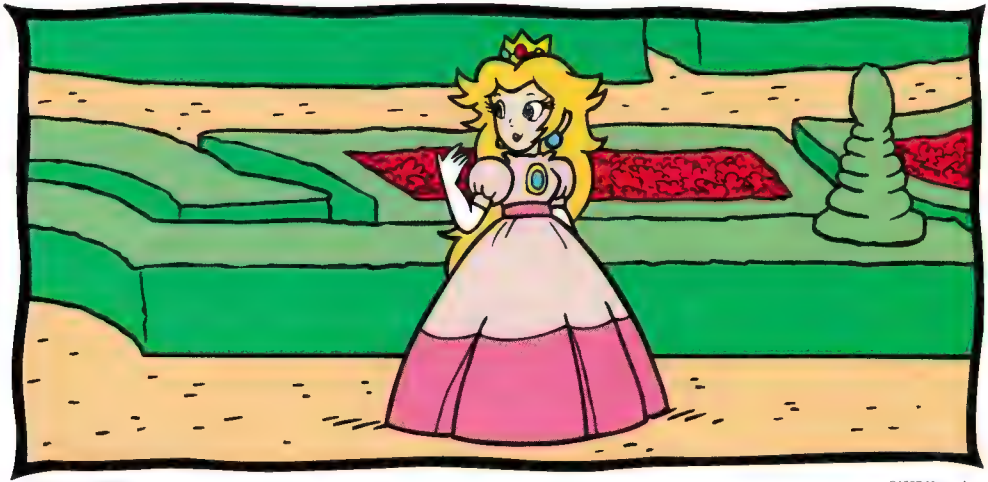


Illustration Gary Fields

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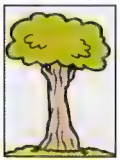
Le Notre

Versailles was the palace of the French king Louis XIV. It's located about 13 miles (21 km) outside Paris, France.

2 Andre Le Notre designed the gardens at Versailles.



© Fusteraga / Sunset

The gardens at Versailles are symmetrical and manicured in the formal French style. Landscape architect Andre Le Notre also designed gardens for King Charles II of England.

Louis XIV was a powerful and vain king. In 1661, one of Louis' ministers, a man named Nicolas Fouquet, held a party in the king's honor. It was a nice gesture, but it backfired. Louis took one look at Fouquet's new home and he was furious. How could one of his assistants have such a beautiful home?! Louis immediately had Fouquet thrown in jail. Then he hired all the people who had built Fouquet's home to build an even grander one for himself.

Gorgeous Gardens

Louis' father had a hunting lodge at Versailles. This was redesigned and expanded into a stunning palace. Landscape architect Andre Le Notre was hired to design the gardens. The land covered about 37,000 acres (15,000 hectares). The gardens at Versailles include a cross-shaped canal, 1,400 fountains, and more than 400 statues.

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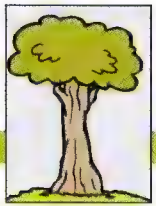
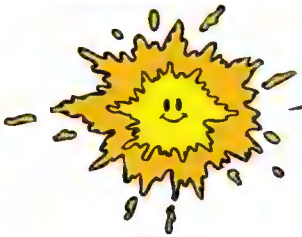
Which part of a plant produces cinnamon?



PLANTS AND TREES



1. Bark
2. Leaves
3. Roots

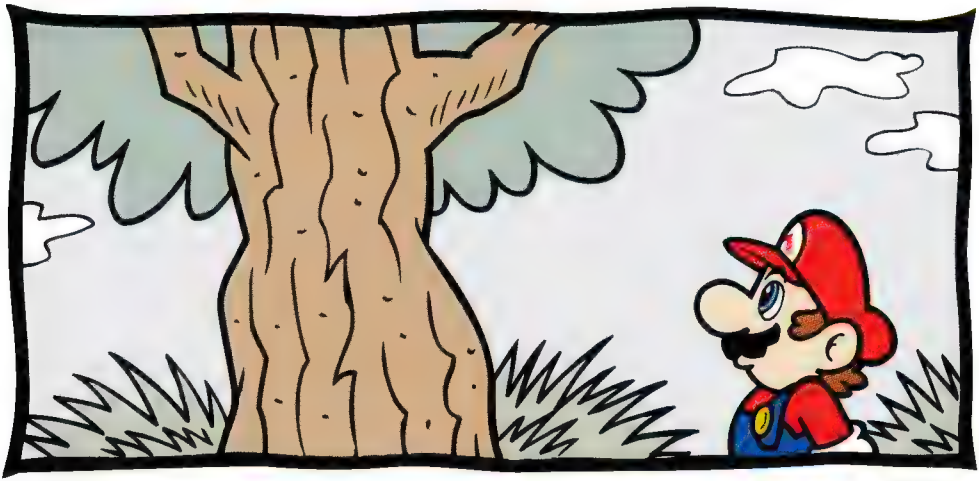


Illustration: Gary Fields

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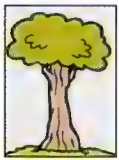
Cinnamon

We generally think of cinnamon as a flavoring for desserts and breads, but it's commonly used as a spice in meat dishes from India, Morocco, and Mexico.

1 Cinnamon is produced from tree bark.



© McCormick/Schilling Spices

Cinnamon comes from the dried inner bark of certain evergreen trees. Here women sort and prepare cinnamon for shipment.

Cinnamon is native to Sri Lanka and India. It was one of the primary spices that lured European traders to Asia. In fact, the scent of cinnamon in Sri Lanka was so strong that sailors could smell it from their ships off shore!

Bark with a Bite

The cinnamon tree is an evergreen with glossy leaves. It produces tiny white flowers and berries, but the secret of cinnamon is in its double layer of bark. The outer layer is a protective coating. The inner layer contains the fragrant spice. Both layers are stripped from the tree and set in the sun to dry. As it warms, the inner layer curls up and separates from the outer layer. Then the inner layer is sliced into cinnamon sticks, ground into powder, or pressed to extract its aromatic oil. The bark grows back in about three years and the tree is stripped again.

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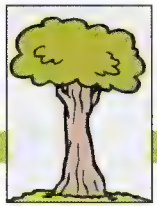
What is reforestation?



PLANTS AND TREES

1. Planting new trees in barren forest areas
2. Trimming tree branches
3. Planting trees in containers

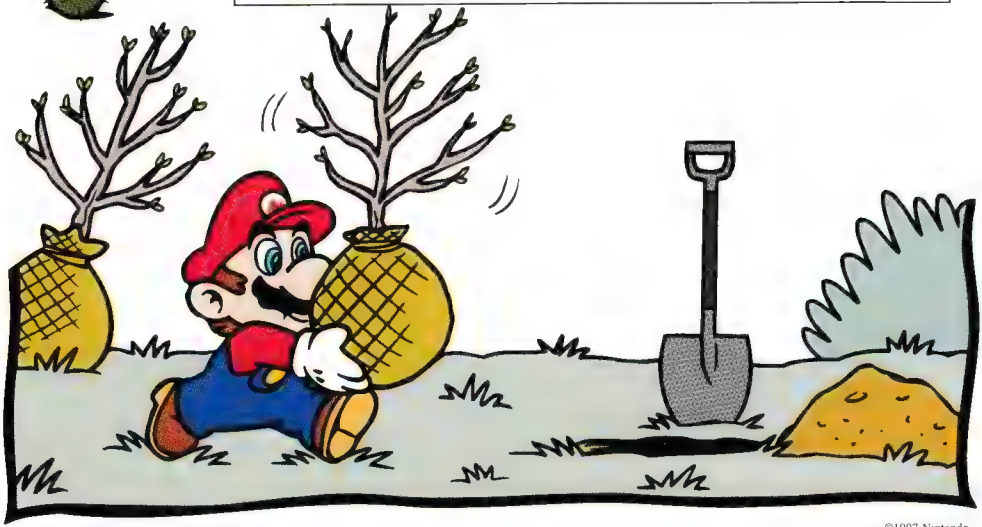


Illustration: Gary Fields

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Forest

If forest land is cleared and then left alone new trees eventually will grow there. This is called second growth forest.

1 Reforestation is planting new trees in barren forest areas.

© A. Le Bot / Gamma

Forests of thin, young trees, like this one, spring up naturally on forest land that has been cleared and then left alone. This is known as second growth forest.

Throughout the history of civilization, humans have cut down trees to provide fuel and building materials, or to create plots of land on which to grow crops.

Replace What is Taken

In the modern logging industry, it's common practice to plant new trees to replace the ones that have been cut down. This is called reforestation. It ensures that the loggers always have a fresh supply of trees, without having to deplete more sections of forest land.

Untouched Forest

Forests that have never been cleared by humans are known as old growth. Their trees have lived for well over a thousand years. Since a tree's trunk grows thicker with every year that passes, these ancient trees are enormous. Some of the old growth redwood trees in California's Muir Woods National Monument, for example, are big enough to drive a car through!

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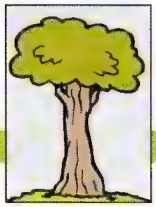
Which is the place where young plants are grown from seed?



PLANTS AND TREES

1. Nursery
2. Planetarium
3. Pottery

Illustration: Gary Fields

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Nursery

The plants and trees you purchase at a garden center are raised in plant nurseries.

1 A nursery is a place where young plants are grown from seed.

© Labat / Jerrican

Plant nurseries oversee the growth of young plants from seed. By the time a plant leaves the nursery, it's ready to be transplanted to a garden or indoor planter.

To grow enough marigolds for a garden display, a home gardener might plant hundreds of marigold seeds in tiny seed pots indoors during the winter. The tender seeds must be kept warm and moist so they can germinate. After several weeks, when the young plants are strong enough, the gardener transplants them outdoors.

Green Thumb

To save time and effort, the gardener could buy marigold plants that were raised in a plant nursery. A typical nursery might raise tens of thousands of marigold plants in dozens of varieties. When the plants are old enough, they're shipped to garden centers and stores where they are sold.

Nurseries are particularly valuable to landscapers who require a wide variety of plants, trees, and shrubs for their work. It would take tremendous effort for the landscaper to grow every plant he needs. So, the nursery does that time-consuming work for him.

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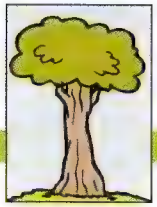
What do houseplants need to survive?



PLANTS AND TREES

1. Sunlight and water
2. Vitamins and minerals
3. Clay pots and fluorescent light

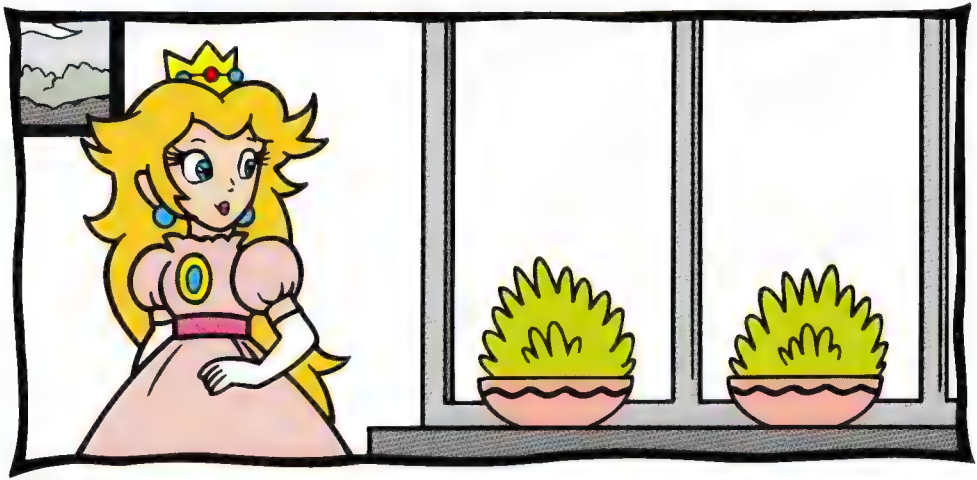


Illustration: Gary Fields

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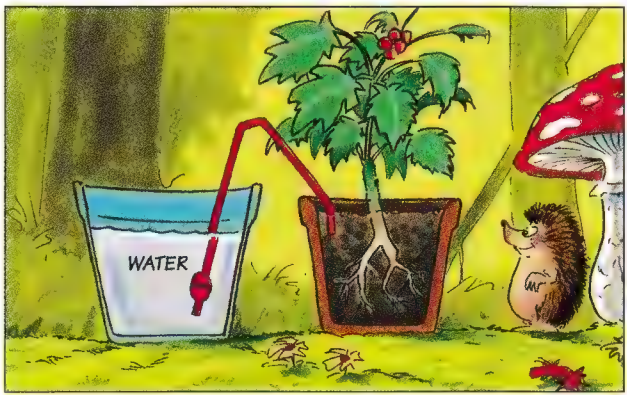
Houseplants

To live and grow, plants need sunlight and water. Houseplants rely on people to provide the light and water they need.

1 To survive houseplants need sunlight and water.



© J. Dang

A simple wick watering system, can be made by placing one end of a nylon "wick" in a container of water and inserting the other end into the soil of a potted plant. Water travels through the wick to the soil to keep it moist.

Every plant has different light and water requirements. Some need direct sunlight; others do best in shady places. Some need frequent watering; others like slightly dry conditions.

Wick Watering

If a plant's soil dries out completely the plant will die. With a small, plastic container of water and a piece of nylon clothesline a person can make a self-watering system for houseplants so the plants receive the water they need whether or not the person is there to water them. Place one end of the clothesline in the container of water and insert the other end deep into the soil in the plant's pot. The nylon fibers draw up the water from the container. It travels along the clothesline and is fed into the soil in the pot. The system delivers enough water to keep the soil slightly moist for a few days.

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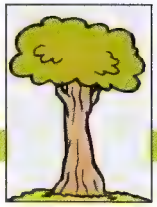
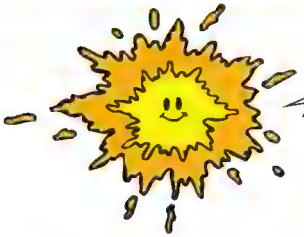
What are shiitake, porcini, and chanterelle?



PLANTS AND TREES



1. Apples
2. Mushrooms
3. Plant diseases

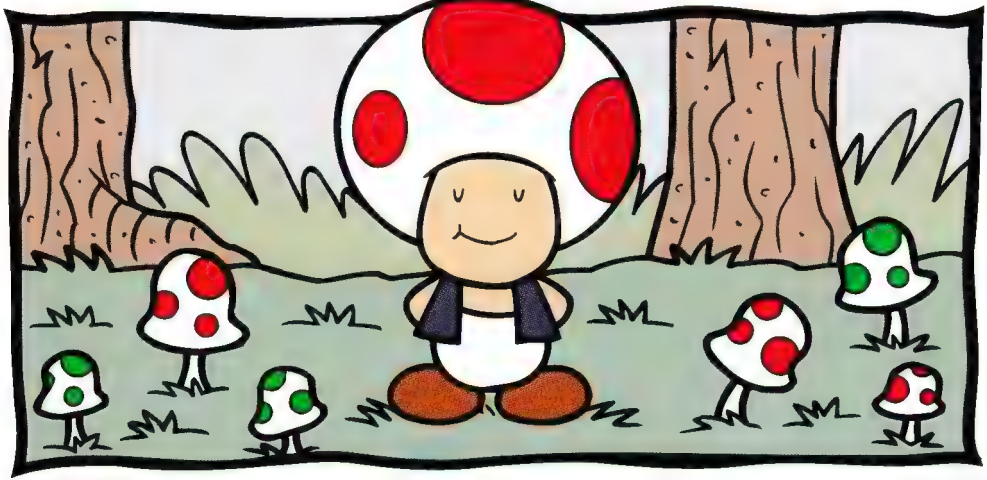


Illustration: Gary Fields

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Mushrooms

Shiitake mushrooms are native to Japan and Korea. Porcini mushrooms, also known as cépes, and chanterelle mushrooms are found in the wild in Europe.

2 Shiitake, porcini, and chanterelle are types of mushrooms.

© H. Veiller / Explorer

It's almost impossible to tell the difference between the basket of edible mushrooms and the basket of poisonous mushrooms. This is why it can be quite dangerous to gather wild mushrooms on your own.

For generations, people went to the woods to gather wild mushrooms to eat. This was fine if you knew exactly what to look for, but some edible mushrooms look so similar to poisonous ones that there was always a danger you'd pick the wrong ones by mistake. Today, edible mushrooms are cultivated on farms and sold in grocery stores.

Uncommonly Delicious

Common mushrooms are grayish white with smooth rounded caps. They taste earthy and mild. Wild mushrooms have stronger flavors.

Dark brown shiitakes may measure as much as 10 inches (25 cm) across. They're so thick that you can grill them on a barbecue. Light brown porcini range from 1 to 10 inches (2.5-25 cm) across. They have a hearty flavor. Chewy chanterelles are bright yellow or orange with a nutty flavor.

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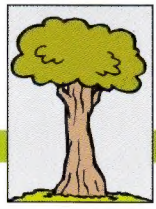
What are Thompson Seedless and Muscat?



PLANTS AND TREES

1 Apples

2 Cheeses

3 Grapes

Illustration: Gary Fields

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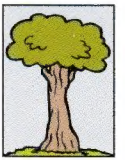
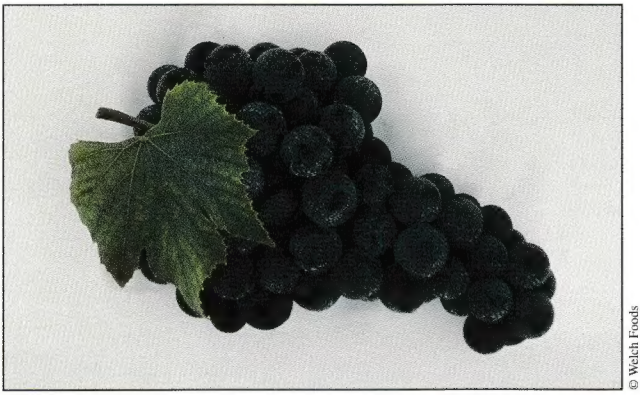
Grapes

California is the largest producer of grapes in the United States. Some are used to make wine and grape juice, others are grown to be eaten as snacks or to make raisins.

3 Thompson Seedless and Muscat are types of grapes.





© Welch Foods

Cultivated grapes can be red, pink, blue, purple, black, golden, green, or white. They are used as dessert fruits and raisins and in the making of grape juice, wine, jams, and jellies.

Wine grapes don't taste very good when they're picked off the vine and eaten. They're acidic, and so sour they'll make your mouth pucker. Though it's unpleasant to eat, the acid is important for the fermentation of the wine. Table grapes, on the other hand, contain little acid and a lot of natural sugar. They're juicy and sweet.

Grape Expectations

The most popular table grapes are Thompson Seedless. As their name indicates, these green grapes (also known as "white" grapes) have no seeds. Ribier grapes, which are big and round with dark purple skins, are also a popular table grape in the United States. Muscat grapes are extremely sweet. Sometimes they're eaten as table grapes, but most are dried to make raisins. A very sweet wine, called muscatel, is also made from muscat grapes.

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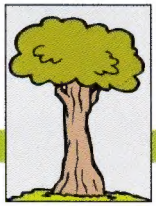
What are Macoun and McIntosh?



PLANTS AND TREES

1 Apples
2 Cheeses
3 Spices

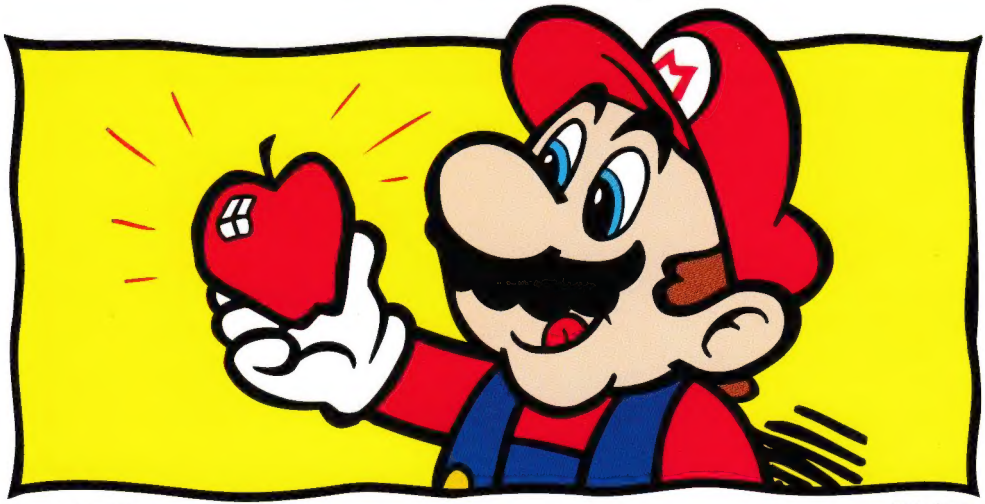


Illustration: Gary Fields

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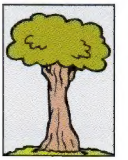
Apples

There are about 2,500 varieties of apples grown in the U.S. New varieties are sometimes created by cross-breeding existing apple types.

1 Macoun and McIntosh are apples.



© U.S. Apple Association

Apples are among the world's most important fruits. They are consumed as fresh fruit—for dessert, snacks, or in salads; baked in pies and stewed into sauce. Apple beverages include apple juice, cider, wine, and brandy.

Small, tart McIntosh apples are among the most popular in the United States. They're named for John McIntosh, who found them growing in Ontario, Canada, in the 1790s.

Macouns—tart, with a deep red skin—were bred by horticulturists. They're grown mainly on the east coast of the U.S.

While most apples are red, there are also yellow apples, such as Golden Delicious, and bright green apples, such as Granny Smith. One yellow apple, called the Jonagold, was created by cross-breeding bright red Jonathan apples with Golden Delicious.

Apple Uses

Certain apples are grown specifically to make juice and cider. Large, tart apples, such as Rome Beauty, are used for cooking and baking. Sweet or sweet-tart apples, like Delicious and Cortland, are great for eating out of hand.

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